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E S S A Y S

RELATING TO

A G R I C U L T U R E

A N D

R U R A L A F F A I R S.

VOL. II.

3 2 2 3 3

THE

AGRICULTURAL

AND

FOREST

THE

E S S A Y S
RELATING TO
AGRICULTURE
AND
RURAL AFFAIRS.

THE FOURTH EDITION,
WITH CORRECTIONS, AND LARGE ADDITIONS.

BY
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VOLUME SECOND.

And he gave it for his opinion, that whoever could make two ears of corn, or two blades of grass, to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of Politicians put together.

SWIFT.

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P R E F A C E.

THE following *Essay* is a very inconsiderable fragment of a much larger work, in which the Author had made but a small progress, when the event mentioned in the introductory advertisement, put a stop to the farther prosecution of it. And as it is possible he may never be in a situation which shall enable him to finish that work as he at first intended, he has been prevailed upon to offer it to the Public in its present imperfect state,—hoping, that even in this imperfect state, it may be of some use in directing the attention of future enquirers to proper objects.—To contribute farther towards that end, the following account is given of the Author's design, and the motives that induced him to engage in this undertaking.

From particular circumstances, nowise interesting to the Reader, he was necessarily engaged in the practice of Agriculture, at a very early period of life; and being naturally delighted with the innocent pleasures which that mode of life presented to an ingenuous

mind, he engaged in the study of it, with an ardour natural to the impetuosity of youth. By consulting such authors on this subject as fell in his way, he soon found himself deeply involved in intricate physical discussions about the *pabulum* of plants,—the influence of salts, oils, acids, and many other like substances, of which he could form but a very vague and indeterminate idea, so as not to be able with certainty to perceive the full force of such arguments as were adduced by these authors, in support of their favourite hypotheses. And being unwilling to be instructed by halves, or to take the word of any author as a *demonstration* of the proposition he assumed, he applied himself with diligence, to acquire a knowledge of those sciences that seemed necessary to be attained, before he could peruse these authors with profit.

But, instead of reaping the benefit from thence that he had at first expected, he had the mortification to find, that these Writers were in general equally ignorant of the real qualities of the substances whose names they employed, as he himself had been; and that each having formed in his own mind, a vague idea of some
imaginary

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imaginary substance, endowed with as imaginary qualities, modelled by his fancy, so as exactly to suit the hypothesis he had assumed, gave it the name of *salt, oil, acid*, or any other that chanced first to occur to his memory,—and then employed it on all occasions to explain every difficulty that might occur with regard to the Theory or Practice of Agriculture.,

And as they for the most part argued with a degree of confidence exactly proportioned to their own ignorance, he found that the influence of these dogmatic Theorists had extended so far as to pervert the minds of practical farmers to such a degree, as to render them in many cases incapable of drawing impartial conclusions from the observations that their own experience afforded. Thus even practical farmers were prevented from writing intelligibly on almost any subject, they being constantly desirous of adapting facts to their own whimsical and absurd theories.

Tired, at length, with repeated fruitless endeavours to attain useful knowledge in this way, and disgusted with the nonsensical jargon he was obliged to read,

he, in a sort of literary apathy, threw aside his books, and resolved to disengage his mind from theoretical reasoning as much as possible, and, with unprejudiced sincerity of intention, attend to practice alone, as the only sure mode of instruction.

Being thus, in some measure, obliged to retire as it were within himself for instruction, and to meditate upon the most effectual means of attaining it, he soon perceived, that as a vague and inaccurate mode of reasoning had been too freely admitted into this science, in consequence of which, conclusions were frequently drawn from premises that could not have been authorised by any accurate mode of induction; it behoved a farmer who wished to make any solid attainments in useful knowledge, to be particularly careful to accustom himself to an accurate mathematical mode of reasoning. And being thus enabled to distinguish between the *essential* and *accidental* circumstances that might on any occasion tend to vary the result of an experiment, he would be cautious how he admitted any thing as a fact upon which any future reasoning should be erected, until it had been previously demonstrated to be such.

But

But when he began to examine into the truth of those facts usually admitted as axioms * in the science of agriculture, it is difficult to describe his disappointment, when, instead of that certainty he hoped for, he found himself continually involved in doubt and uncertainty. Nor does he imagine, that any one who has not examined this subject with the same attention that he has done, could think it possible that an art which has been practised for so many ages by all civilized nations, should be still involved in such great uncertainty, in almost every particular, as it will be found to be.

This being the case, it was obvious that materials for forming any rational theory of agriculture were so very scanty, that little else but hypothetical conjecture could be expected in that way, until facts were more accurately authenticated. And as he is sensible it requires an un-

* Axiom, in mathematics, is a term employed to denote those self-evident truths that are so obvious to the understanding as to be readily recognized as such, without any sort of demonstration, and therefore serve as a basis upon which other demonstrations may be erected—Such as, a part is not so great as the whole, &c.

commonly

commonly philosophical turn of mind, and cultivated understanding, to be able to select with judgment such leading facts as might serve as a basis to an infant theory, or to make such experiments as might be decisive in this point of view, he wishes to turn the attention of the practical farmer altogether from these vain pursuits, and to persuade him to be contented with viewing it as an economical art, on the proper knowledge of which, as such, his prosperity and happiness depend. Happy will he deem himself, if his efforts in this way shall be attended with success.

Leaving, therefore, the philosopher to pursue his sublime speculations, and proceeding in the more humble walk to which he had confined himself, it readily occurred, that as those who practise Agriculture are usually confined to a particular spot, their observations must necessarily be confined to those few objects that come within their own narrow sphere. And as their attention is usually employed in cultivating such plants, or rearing such animals, or prosecuting such a mode of culture as chance may have recommended to their notice, without being acquainted with all the varieties of these that may

be

be met with in different parts of the earth, or knowing the cases in which others might be substituted instead of them, with advantage; they are, in a great many cases, ignorant of what might be done for their own emolument, nor know they how to make the greatest advantage of their own particular situation:—so that, not being sensible of their real wants, they remain contented with what they only know in part, without making those efforts, which, if properly directed, must naturally tend very much to improve that art which they practise.

In these circumstances, he imagined that nothing could promise to be of more real utility to the practical farmer, than a work that was calculated to present to him a concise view of all those objects that should have a claim to his attention, when he was so circumstanced as to have any particular object of pursuit in view; that, by thus having a distinct knowledge of all the circumstances that could affect him, he might be in no danger of overlooking any of them. He would thus be enabled to advance with some degree of certainty, instead of pursuing that devious and desultory course, to
which

which he is, in the present situation of affairs, so much exposed.

In pursuing these disquisitions, he imagined, that as the proper business of the farmer may be said to consist in rearing such crops as may be useful to man, and in managing or disposing of these so as that they might turn out to the greatest benefit to himself, and good to the Public, the whole of the objects that could lay claim to his attention might properly be reduced to the three following general heads, *viz.*

1st, The knowledge of the different properties of all the plants that can be raised by the farmer;—the different uses to which these can be in any case applied; and the most economical method of consuming, or otherwise disposing of them.

2^d, The knowledge of the nature and distinguishing qualities of the different animals that may be kept for carrying on the various operations of Agriculture, and of those that are reared for the purpose of consuming these plants; and the proper method of treating the

different varieties of them, so as to make any one kind of food, on all occasions, produce the greatest possible effect. And,

3d, The knowledge of soils; the way of manuring and cultivating these, so as best to fit them for rearing such valuable plants as may be most beneficial to the farmer. For,

Unless a man is acquainted with *all* the plants that can be reared in his soil or climate, and with *all* the distinguishing qualities, and peculiar properties * of each, so as to know with certainty in what circum-

* This passage has somewhat the appearance of a tautology, or unmeaning amplification, that the Author knew not how to avoid. By *distinguishing qualities*, he would wish to denote those peculiarities that are often remarked in the manner of growth, time of vegetating, &c. of plants; and by *peculiar properties*, he would be understood to mean the medical qualities, if he may use that expression, or those qualities by which they are fitted to affect the animal economy, when consumed by any living creature. The meaning of this distinction will be more obvious from many passages in the following Disquisitions.

stances any one of these could be raised to the greatest perfection, and for what purposes they could be most economically employed, he cannot be said to have attained a perfect knowledge of rural economics *.

Unless a man is acquainted with *all* the animals that it is in his power to rear, and knows the peculiar distinguishing qualities, and the most proper method of treating each class of animals, in all circumstances; the several products that may be obtained from each, and the easiest method of increasing or diminishing any one of these, as he may find best to suit his circumstances—he must be considered as ignorant of a very important branch of knowledge in this art. And,

Unless he knows the particular soil, and the mode of culture, that is best adapted to rear each of these plants,

* I have here ventured to adopt a term from a foreign language, for want of a proper one in our own. The word Agriculture, in English, is often understood to express all those circumstances that belong to the science here treated of,—although, from the obvious etymology of the word, it seems to be forced from its natural and proper signification.

to the greatest possible perfection, he cannot practise the art of Agriculture, with all the advantage that he might otherwise derive from it.

But if he knew, in every case, what plants his soil, in the state in which it might chance to be in at any one time, could rear to the greatest perfection;—if he knew the manner of treating that soil, so as to bring it to rear other plants that it was not naturally fitted to produce;—if he were thoroughly acquainted with all the distinguishing qualities of every one of these plants, and knew with certainty the way in which they might be disposed of, or consumed with the greatest advantage to himself;—and if he were perfectly acquainted with the nature and peculiar qualities of every animal that he could rear, and particularly instructed in the best method of managing such animals as the plants he could raise were best adapted to nourish, so as to make every particular species of food produce the greatest possible effect;—he would on all occasions be able to employ his time and labour to the utmost advantage to himself, and benefit to the public, and might be said to have attained the highest degree of knowledge in this art that could be desired.

Whether

Whether it is possible for human powers ever to attain to this summit of perfection, is extremely doubtful. But it is probable that those will come nearest to it, who, having their eye constantly fixed upon the goal, know, with some degree of certainty, the distance they are from it, and the obstacles that must be overcome before they can reach it; and, with a well-directed perseverance, steadily press forward with unremitting ardour.

To assist such ingenious enquirers, it was proposed to enter into an accurate examination of all the particular branches that might appertain to each of the general heads above enumerated;—to endeavour to point out, under each particular head, what were the circumstances that it would be of the greatest importance for him to know;—to enquire with accuracy, what particulars relating to each particular head had been already discovered:—to distinguish, by a careful discrimination, the facts that had been established with certainty, from those that had been adopted without sufficient proofs;—and to lead to the most probable means of prosecuting future discoveries.

Such

Such was the original plan of that work which gave rise to the following disquisitions:—But the enterprise was arduous, and the situation of the Author by no means favourable for completing such an extensive undertaking: upon which account, as well as the discouraging event mentioned in the introductory advertisement, the prosecution of it upon that large scale has been laid aside.

What is now offered to the Public, can only be looked upon as a bare skeleton of a small part of that work; the following sketches containing little else than a few unconnected doubts and queries, with a view to direct the attention of the farmer to some objects that do not seem as yet to have been sufficiently elucidated, without so much as an attempt to accomplish the other parts of the plan. Probably, it may at least be useful, in so far as it will tend to give a check to the presumptuous vanity of those who through ignorance of the limited state of our knowledge with regard to this art, are apt to think themselves thoroughly acquainted with every particular relating to it, when they have only got a slight smattering of the rudiments of it: For, it is imagined that few

persons who shall take the trouble to peruse these sketches, will be able to avoid perceiving, that it is hardly in his power to give satisfactory answers to many doubts that are there started, or to deny that it would be of great importance to the farmer to know them.

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MISCELLANEOUS

MISCELLANEOUS DISQUISITIONS,

DOUBTS, AND QUERIES,

RELATING TO

A G R I C U L T U R E.

VOL. II.

B

*In omnibus rebus, et maximè physicis, quid non sit citius
quam quid sit dixerim.*

CICERO.

ESSAYS, &c.

MISCELLANEOUS DISQUISITIONS,
DOUBTS, and QUERIES, relating
to AGRICULTURE.

I.

IT can hardly be doubted, that some plants afford more nourishing food for certain domestic animals, than others:—The well-instructed farmer, therefore, ought to know which of all the plants that are or may be cultivated by him, will soonest fatten any species of animals that he may have it in his power to rear; as also the comparative degree of nourishment afforded by each of these plants to each species of animals respectively.—Wanted, on this account, an exact list of all the plants that will be eaten by, and may be employed as food for cattle*, arrang-

* *Cattle* is here employed as a general term, denoting all the animals of the cow (or *Bos*) kind.

ed in order, according to the degree of nourishment they will afford; beginning with those that are most nutritive, and descending to such as will hardly be eaten by this class of animals, or that afford them only a bare subsistence?—Wanted also, a similar catalogue of plants with respect to horses,—sheep,—goats,—hogs,—rabbits,—geese,—and every other species of domestic animals that could in any case become an object of the farmer's attention.



The benefits that would accrue to the farmer from the knowledge of the above-mentioned particulars, are so obvious, as hardly to need being pointed out. It is evident, that he would thus be made to know exactly, not only what kind of plant would be most proper for him to endeavour to cultivate in his own particular situation, but would also know in what manner he ought to consume any particular plant that chance or necessity might throw in his way, so as to make it turn out to his greatest profit. Yet, the experience

perience of every reader will easily satisfy him, that so far are we from having attained the accuracy of knowledge required above, with regard to *all* the domestic animals, that we hardly as yet know the exact comparative value of any two plants with respect to any single animal; not even the favourite horse himself, who has long obtained such a particular share of attention. It is, indeed, in general, known, that certain plants may on some occasions be employed with profit for fattening some particular animals; but the exact proportional value of each has never, in any case that I have heard of, been ascertained by proper experiments, with that degree of precision which would be necessary in this case.

The only thing that approaches to this, is the attempt that the Swedish Naturalists have made in the *Pan Suecicus* (*Amoenit. Acad.* Vol. III.) in which they have, by a numerous set of experiments, endeavoured to discover what plants are eaten or rejected by the five most common and most valuable kinds of domestic animals: oxen,

6 DISQUISITIONS

sheep, goats, horses, and swine *. But as it is by no means certain that animals always show a preference for those kinds of plants that afford them the most nourishing food, or the reverse †; the plan that

* See the Appendix.

† Although it may be presumed, that in general, instinct points out to animals the plants that are hurtful to them, or the reverse; yet experience sufficiently shows, that this cannot be relied upon as an invariable guide—among domestic animals at least; which, by having little freedom of choice from their infancy, have their taste, in all probability, depraved, as well as our own.—I have seen an ox that on no account could be brought to eat turnips; and there are very few put upon them, who do not eat them at first with some degree of reluctance, if they have not been sometimes accustomed to taste them before: yet it is very well known, that few kinds of food are more nourishing or palatable to cattle, after they have been once accustomed to it. In the same manner, sheep that have been accustomed to eat whins (furze) browse upon them at all times greedily, and prefer them to almost every other kind of food; whereas, others that have not been accustomed to this plant, will never touch it, till they are reduced to the greatest extremity by hunger; although few plants, perhaps none, afford a more nourishing food for sheep than this. The same might be said of Burnet, Myrrh, and a great many other plants, which are for the most part refused at first by such animals as have not been accustomed

that they have proceeded upon in this valuable set of experiments, does not entirely answer the purpose here required, nor afford us that degree of certainty in this respect that could be wished for. Experiments, therefore, are still here wanting: Nor can these ever in this case be conclusive, unless they are carried on upon a large scale, and so much varied as to guard against the particular exceptions that might be occasioned by particular idiosyncracies *, or particular habits of body in the animals.

customed to them, although they are afterwards eaten with a sufficient relish.

And if the reluctance that an animal shows to eat any plant that may be offered to it, does not always indicate that such plant is unwholesome, so neither does their eating it at first freely afford a certain proof that it is innoxious. Thus Linnæus observes, that animals which have been accustomed to feed in the open fields, are frequently hurt when carried into woodlands, by eating plants that are pernicious to them, which the cattle that had been bred in these last pastures have learned by experience to avoid. Here, then, it is *experience*, and not *instinct*, that guards from danger.

* *Idiosyncrasy* is a term used by physicians, to denote certain peculiarities with which particular animals may be affected, that is by no means common to others of the same class. Thus one man may have a natural an-

animals upon which the experiments have been made.

It would be no difficult task to point out such a train of experiments, as, if faithfully executed, would bring this particular to the certainty required. But as it would require little less than princely munificence to execute that set of experiments properly, it is perhaps unnecessary here to propose them. How much is it to be regretted, that this nation, which gives the most liberal encouragement to almost every other kind of improvement, should never have thought of applying a small portion of the public money (and a very small proportion would suffice) towards the prosecuting of such national experiments in Agriculture as exceed the power of individuals to perform; and thus bring certainty into an art the most useful and essentially necessary to the existence and well-being of mankind! The present instance is a striking example of the real utility of such an institution.

tipathy at one kind of animal, or at one kind of food, which no reason can overcome, or length of habit reconcile: This is called an idiosyncrasy.

II.

Hitherto the attention of the farmer has been too much confined to the common herbaceous plants that spring up in the fields, and are usually eaten by our domestic animals in their native state.—Is it not probable, that there may be many plants that do not seem at first sight to be reducible to this class, that might be profitably cultivated as a crop for food to some of our domestic animals?—If so, What are they?



It is not necessary here to take notice of cabbages, coleworts, turnips, the cole-feed plant, &c. which have been long known to be good kinds of food for cattle and sheep, although they have only of late been generally cultivated as a field-crop by the British farmer.—I would wish here to turn the attention of the reader to the examination of some other plants that have not been commonly thought capable
of

10 DISQUISITIONS

of affording good and wholesome food for domestic animals.

The Myrrh plant * (wild Cicely or Cow-weed) is often seen growing in neglected corners, with great luxuriance, early in the spring; and, in that state, is seldom eaten by any kind of animal, unless by sheep, which sometimes crop it.—But it is not in general known, that this plant affords one of the most nourishing kinds of food that can be found for cows and other sorts of cattle, at a season when few other green plants can be met with; and might undoubtedly be cultivated for that purpose, with very great profit, by the farmer.

The same might be said of the *Willow-herb*, or French Willow *:—a plant that grows with luxuriance upon some soils where few other sorts can be made to thrive. The young shoots of the *Epilobium*, if cut before they harden too much, af-

* *Chaerophyllum sylvestre*.

As plants have very different English names in different places, to prevent the mistakes that might arise from this cause, I shall subjoin the Botanical names of such as are universally known.

† *Epilobium*.

ford an abundant and wholesome food for cows, at any early season—before the common kinds of grasses are fit for being cut,—as I myself have often experienced*.

It has been discovered of late, that the roots of carrots are readily eaten by horses, and yield them plentiful nourishment.—Probably many other roots, that are now neglected, might be employed as a rich food for horses, and other domestic animals.

Potatoes are well known to afford abundant nourishment to cattle—and horses; and probably they would be equally nourishing to all the other domestic animals.

It seems also probable, that the *roots* of the Myrrh plant, if ever it should be extensively cultivated as a crop, would be of very great value in this respect;—as cattle, when they have once been made acquainted with the taste of this root, become extremely fond of it. The weight of roots of this sort upon an acre of

* The *Chicorium intybus*, lately introduced as a cultivated crop into Britain, possesses qualities somewhat akin to this.

ground,

ground, when fully grown, would be inconceivably great.

Cattle are also extremely fond of the roots as well as the tops of the Carraway plant *, which might on some occasions be employed for the same purposes.

Beets † were formerly more cultivated in our gardens than at present. Perhaps, they ought to be chiefly valued as a food for cattle. They carry abundance of succulent leaves, which are readily eaten by cattle;—but their roots, which used always to be thrown away, would be the principal crop as a food for cattle. These roots contain a larger proportion of saccharine juice than any other plant common with us. An ounce of grained sugar has been extracted from a pound of the green root: and it is well known, that nothing fattens animals in general so quickly as plants that contain sugar in large proportions ‡.

Sheep seem to show a greater fondness for the roots than any other part of many

* *Cerum carvi.*

† *Beta vulgaris.*

‡ The root of scarcity which has attracted the attention of the public a good deal since the above was written, belongs to this class of plants.

plants, and would probably be much nourished by them, if we were at pains to select such plants for cultivating for other uses, as had roots that were peculiarly grateful to them; and the value of such crops might be greatly augmented by this circumstance.

Sheep are uncommonly fond of the leaves of the common Dandelion *, and other plants of the same class;—but they will leave almost any other sort of food, to search for the *roots* of the Dandelion among ploughed fields, where these abound. They are also exceedingly fond of the roots of all the plants of the Hawkweed tribe †.

They likewise search with avidity for the roots of the common Mugwort ‡.

And they are also very fond of the root of grassy-leaved Plantain §, which sometimes grows to a considerable size.

Whether they or swine, or any other domestic animal, would eat the roots of the *Epilobium*, which are extremely tender, and very numerous, I cannot say:—But

* *Leontodum taraxacum.*

† *Hieracium.*

‡ *Artemisia vulgaris.*

§ *Plantago minima.*

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if they did, it might be cultivated on many occasions by the farmer, with greater profit than almost any other crop.

I do not know if any use has hitherto been made of the roots of the Lucerne.— These, where the crop has been luxuriant, are extremely large, and afford a saccharine juice, that would probably be very nourishing to some sorts of animals. The roots are indeed tough and stringy in their natural state;—but if mashed by a stone rolling about on its edge like a tan-mill, or by any other contrivance, they would become tender enough for use.

The same might be said of *Sain-foin* (*Saint-foin* vulgo) roots. But of these I speak less positively, not being so well acquainted with the nature of them.

But no plant that I am acquainted with, promises to be more valuable in this way, than the garden everlasting Pea; the roots of which grow in time to a very large size, and are full of a rich saccharine juice, little inferior to the garden liquorice.

How these roots could be most easily taken out of the ground, might be enquired

quired into, after their several qualities were fully ascertained.

Many other roots might be mentioned—some of which grow to an enormous size, and are just now accounted of no value, that might possibly be of great use as food for domestic animals.—All these deserve to be examined: for some of them might perhaps admit of being profitably cultivated as a crop; and others, which, though they could not be thus employed, might still be of great utility in supplying the deficiencies of a scanty crop, were they properly known.

Necessity has been, with some appearance of justice, called the mother of invention—and some persons have so strongly annexed the idea of want and poverty to every economical experiment of this kind, that they would be ashamed to be seen making them. Those may reckon themselves happy who are under no *necessity* of exerting their genius in this manner, and ought thankfully to avail themselves of the *forced* experiments of the poor. But it would be more for their honour, if they, with a liberal spirit of enterprize,

enterprize, made the discoveries for themselves.—Many trials may prove abortive;—but if one, among a great number, succeeds, they will have the agreeable satisfaction to *feel*, that they have not been entirely useless to their country and posterity:—Nor do they spring up on the face of the earth, and decay like the weeds of the field, that only incumber the ground for a season—are trodden under foot, and soon forgotten,—or are only remembered with abhorrence and disgust.

In the northern regions of Norway and Lapland, the inhabitants are obliged to try many plants as food for themselves and cattle, which have been neglected by those whose milder climate leaves them a greater variety to choose from. They gather the leaves and tender twigs of various sorts of trees, which they carefully preserve, instead of hay, for their bestial, and find that it affords them as abundant nourishment as any hay whatever*. Ought

* And in the southern parts of France, Italy, and in India, they gather the leaves of trees, with which they feed their beasts in summer, when the grass is burnt up by the parching heat of the sun.

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not this to afford us a hint, not to neglect our own trees or shrubs; some of which might be employed with profit, even by us, were their qualities sufficiently known?

The most valuable hay that the Romans were possessed of, consisted of the leaves and twigs of a shrubby plant,—the *Cytisus*.

And the experience of many persons in the north of Scotland, as well as of some of the discerning few in England, has sufficiently proved, that the tender twigs of the common whin*, (furze), when bruised, afford a more wholesome and nourishing winter-food for horses and cattle, than perhaps any other plant that has ever yet been discovered,—not excepting the Roman *Cytisus* itself: Yet few experiments have been made, to discover the most proper manner of cultivating this valuable plant †.

Another

* *Ulex Europæus*.

† Since the former edition of this book was published, I have learned, that the tender twigs of the common Scots Fir affords a wholesome food for cattle and sheep. In the spring of the year 1782, fodder for

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Another plant that might possibly be of use to the farmer in this way, is the common *Laburnum*. This is nearly allied to the Roman *Cytisus*, in its botanical characters. Its leaves and tender shoots are very much liked by cattle; and it grows with such a rapid luxuriance when young, as seems to promise that a very great weight of hay might be obtained from an acre of ground under this crop.

It may perhaps appear a little extraordinary to some readers, to hear of a proposal for making hay from trees; yet they have seen, that the only nation of antiquity which made agriculture its particular study, followed this practice with success.

cattle was very scarce in the north of Scotland; and the season was so backward, that many cattle died before the grass sprang up. On that occasion, one gentleman kept 250 head of cattle alive, and in good health, for upwards of two months, without any other food but the twigs of common fir. The branches were cut fresh for them every day, and in this case were given to the cattle in the house.—Another gentleman kept several cattle abroad during the whole winter, with scarce any other food but the twigs of this tree, which were cut down every day for their use. The cattle came and readily browsed upon them. Horses take to this food with greater reluctance.—Sheep, I am told, eat it heartily.

Nor

Nor will this appear so extraordinary, when nearly examined, as it may seem at first sight. The shoots of the laburnum, as well as of many other trees, are as tender while young, and as entirely herbaceous, as those of clover, or any other of the most succulent grasses; and if these twigs were cut while in that state, they might perhaps afford as nourishing hay as clover or lucerne.

The Lucerne plant, which affords, beyond any degree of comparison, the most valuable hay that we moderns are acquainted with, if suffered to run to their full length for a whole season, are more firm and woody than the shoots of the Laburnum at the end of the season.

It is well known, that almost all sorts of deciduous trees, when cut over close by the ground, send out strong and numerous shoots, which quickly attain a much greater magnitude than if the tree had been suffered to grow in its ordinary manner. The shoots of a willow managed in this way, will often exceed nine feet in a season, which would not have been above two or three if the stem had not been lately cut over.

I have often seen the shoots of a young *Laburnum*, in ordinary health, without amputation, exceed four feet in a season:—If a vigorous stem had been cut over close by the ground, these shoots would probably have been much above that length. These young shoots are extremely herbaceous, and are covered closely, over their whole length, with numerous large succulent leaves, which, in figure, taste, and smell, greatly resemble those of red clover*.

If,

* There are two sorts of *Laburnum* common in this country, which may be distinguished by the appellation of the *broad* and *narrow-leaved* *Laburnum*. It is the first sort I here allude to, in all that has been said above.

The shoots of this sort are long, irregular, and hang dangling on every side; the leaves are large, have long and weak foot-stalks, soft and pliable to the touch, and are of a light-green colour, with a slight tinge of red on the young stalks. The flowers are smaller than those of the other sort; and the pods are flattened, with a soft pliable skin upon them.

The pods of the other sort are hard, round, and somewhat knotty; the leaves smaller than the other, and of a darker Saxon-green colour, with shorter and stronger foot-stalks. The branches grow more erect, and are garnished with much fewer leaves.—This sort

is

If, then, a plot of ground were filled with the roots of this sort of tree, and the stems cut over close by the ground, a great number of these herbaceous shoots would spring up from every one of these stems, which might be cut over with a scythe at any time in summer, with as great ease as a crop of clover; and might either be made into hay, or consumed green, as should be most convenient for the farmer. These shoots spring up much earlier in the season than red clover, and might be cut once, twice, or thrice in a season, as should best suit the purposes of the owner.

The roots would continue to increase in size, and the annual shoots in vigour, for many years, and yield successive crops without any additional trouble or expence,—if it should be found, upon trial, that the hay or grass (if I may use that phrase) was of a valuable sort.

Nearly the same thing might be said of is a more beautiful tree, but would not answer the purposes here required near so well as the other.

These trees, after they are ten or twelve years old, produce abundance of seeds, which spring up as readily as cresses, if sowed in a good soil.

the common wood-bine, or honey-suckle*; some of the freest shooting, and most herbaceous sorts † of which grow to a very great length in one season; and, if managed in the same manner, would, no doubt, yield a prodigious weight of fodder. I find, that some cattle ‡ eat the leaves and tender shoots of this plant without

* *Lonicera Periclymenum.*

† There is a very great difference in this respect, among the different kinds of wood-bines. The wild sort, with woolly leaves, and long thread-like stalks, would be very improper. The best sort seems to be one that has thick and strong shoots, of a greenish colour, with a tinge of red on one side, large bright-coloured smooth succulent leaves, and a large tuft of big flowers, yellow tinged with red on the outside, which begin to open about the middle of June, and continue to blow till the end of the season.

‡ The reader ought to be informed, that there is a very great difference among cattle in this respect. Some cows, especially those that have been bred with gardeners, refuse hardly any green thing; others can scarcely be prevailed with to eat any thing but common grass. The best way to bring a beast to eat any kind of food it has not been accustomed with, is to make it stand near one which eats the kind of food you mean to give it. In a short time, most animals will be brought, in this manner, without constraint, to eat almost any sort of food that others do.

reluctance.

reluctance. Whether it would afford them a wholesome nourishment, I have not had experience enough to say;—but there is no reason to think it would not.

Willows, and many other trees, afford long and tender shoots, which might possibly be of use in this way on some occasions, were they properly tried.

This is a walk in agriculture, that may be said to be in some measure untrod: and although these observations may to some appear whimsical, yet the subject does not on that account the less merit the attention of the liberal-minded enquirer into the principles of rural economy.

III.

It is supposed, that some plants may not yield such wholesome food for animals when green, as when made into hay; and that, perhaps, others, on the contrary, afford better nourishment as a green food, than as a dry.—Wanted, an exact list of all our plants, compared with one another in this respect, with regard to each of the domestic animals above named.



With regard to mankind, we know that many plants, which, when green, are hardly fit for food, become extremely nourishing when dry;—and that some are even poisonous in that state, which afterwards become an agreeable and wholesome food;—as the Cassava-root. And as the *virus* * of many plants depends upon a very volatile essential oil, that may be evaporated in drying the plants, as happens with regard to the root of the horse-radish †, it is extremely probable that the qualities of the same plant may frequently be very different in a dried or a green state. Till the farmer, therefore, is made acquainted with this particular, his knowledge is not so great as it ought to be; and he must be often at a loss to know which plant he ought to cultivate

* I have ventured to adopt this word, as I know no proper English word that is equivalent to it.—It is here employed to denote that particular power by which plants are enabled to produce any sensible effect upon the animal system, whether this be salutary or pernicious.

† *Cochlearia Amorica.*

for

for any particular purpose, or which way he could consume any particular plant to the greatest advantage.

IV.

It is probable that some plants, which may perhaps be possessed of the same qualities when green as when in a dry state, may nevertheless be more properly and economically consumed, by cutting them green, and employing them in that state, than by allowing them to be made into hay ; and, in some cases, perhaps, the reverse of this may be the case.—Wanted, a list of each of these classes of plants as above.



Broad clover, and many other succulent plants, are with some difficulty made into hay ; and, in all probability, may be consumed much more profitably as a green than as a dry fodder : because, as soon as they are cut over, the plants quickly vegetate afresh during the summer-season ; and, by being repeatedly cut over, produce

duce a much greater weight of forage than if they had been allowed to bring their seeds to maturity. For it is observable of almost all these succulent plants, that they push out very vigorous shoots soon after they are cut over, which advance with great rapidity until the plant hath attained nearly its full stature; after which period, it advances more slowly, till it at length becomes entirely stationary, and is solely employed about the formation of its seeds. Now, if the plant be always cut when it approaches towards that stationary state, it will be always kept in the state of vigorous vegetation; and thus it would seem that a much greater quantity of vegetable matter would be produced, than if it were allowed to arrive at greater maturity before each cutting.

This is still more apparent with regard to Lucerne than broad clover. This plant, if allowed to come to its full size, will, in a good soil, attain the height of four feet, or a little more, in one season. But I myself have cut a plant of Lucerne six times in one season, allowing it to be
about

about twenty inches high before each cutting; which gives upwards of ten feet for the growth of one year;—considerably more than double the height that it would have reached if it had not been cut at all. And although it be acknowledged, that the more succulent shoots, obtained in consequence of frequent cutting, would not contain such a quantity of solid matter, as an equal weight of the better matured stalks would have done; yet it does not seem at all probable, that the deficiency arising from this cause, would nearly counterbalance the surplus quantity obtained by frequent cutting. This is an object, among many others, that cannot be determined exactly without accurate experiments.

On the other hand, it would seem probable, that some of the culmiferous plants* or grasses (*gramina*) properly so called, being less capable of recovering themselves after being cut over, when the stalks have been allowed to advance to

* Culmiferous plants are such as carry an erect hollow jointed stalk, as wheat, oats, rye, &c.

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any considerable length (as is evidently the case with regard to common rye-grafs *) would afford but poor returns if cut green, although they may yield a very weighty crop of hay if suffered to attain a proper degree of maturity. But however great the probability is that this may be the case, still it is no more than a probability. Nor can the farmer hope to arrive at certainty in this case, till he knows, by accurate experiment, not only the exact qualities of each of these plants when green or dry, but also the quantity of each that can be produced upon the same soil with equally skilful management.

V.

Some plants that may be equally nourishing to animals, and that equally require to be consumed green, may nevertheless differ in this respect, that one class

* *Lolium Perenne*. Properly, perennial darnel-grafs, improperly called rye-grafs; as there is another plant, *secale villosum*, properly called rye-grafs, that has no other English name.

may

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may be more economically consumed by having the plants cut, and given by hand in that state to the animals that feed upon them, while another class may be more profitably consumed by being depastured by animals.—Required, a list of each of these two classes of plants.



It will be in general allowed, that the two plants mentioned above, broad clover and Lucerne, are more advantageously consumed when cut and given green by the hand, than when pastured upon. Probably, this may likewise be, in some measure, the case with all quick-shooting strong-stemmed plants, that do not grow close enough at the root to form a firm bottom for animals to bite upon. It is likewise probable, that, in general, such close-growing leafy grasses as require to be consumed green, and other weak succulent trailing plants, which run along the ground, and form a thick sward there, but do not rise quickly to a great height, so as to admit of being readily cut by the scythe, would be more profitable for pasturage.—But, here again, we are in the region of probability ;

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probability; nor do we as yet know, with any degree of certainty, either the different plants reducible to each of these classes, or the several limitations that in particular circumstances might take place with regard to any of these.

On this subject, it may not be improper to take notice of a circumstance that ought not by any means to be overlooked by those who are obliged to supply the want of accurate experiments, by probable reasoning from detached facts that accidentally occur.—It is this: by accurate observations, any one may soon be satisfied, that if the flower-stalks of the greater part of culmiferous grasses are destroyed after they are fully formed, the plants do not attempt to form other flower-stalks that season, but run afterwards chiefly to leaves, and spread by their roots. Now, if in this state these plants are allowed to remain for any considerable length of time, without being either pastured upon or cut, the leaves gradually stop from growing,—remain after that for some time stationary, and then fade away, if they are not so luxuriant as to rot; and

in this way, the whole produce of a field may frequently amount to no more than a few inches in length in a season. But if these leaves had been cut over, or afresh bit down by the animals pasturing upon the field several times, the vegetation would at each time have been renewed, and it would have produced perhaps five or six times more than if this repeated cropping had been omitted.

This I once had an opportunity of being satisfied of experimentally, with regard to two plants of sheep's fescue-grass *, which grew upon the same soil,—were in equal health, and in every other respect alike when the experiment was tried. The leaves of each of these two plants, before the end of May, or beginning of June, had advanced to about six inches in length, and after that remained quite stationary for some weeks:—Observing which, I cut off with a sharp knife, all the leaves of one of the plants quite close by the ground; and in a very few days it pushed out a set of fresh leaves with great vigour. These were cut three or four several times during

* *Festuca ovina*.

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the remaining part of the season, when about the height of three inches at each time; although it was not possible to remark the smallest increase of one blade upon the other plant, during all that time.

From this experiment, it would seem that we might fairly draw the following obvious corollary, *viz.* That if grass, in these circumstances, is to be consumed either by pasturing or cutting, it is the greatest want of economy to allow it to remain long between each of these operations; and if we mean to reap the full profit from the field, the oftener these cuttings are repeated, after the grass is of a sufficient length for a bite to the animals which may pasture upon it, or for the scythe to strike it, so much the better.

From this experiment, we may farther infer, that it will be in general perhaps more for the advantage of the farmer, to consume grasses of this sort by pasturage than by cutting; for, as these grasses are always much closer at the roots than the top, when we attempt to cut them by the scythe, unless the field is as smooth as a bowling-green, a great deal of the closest
of

of the pile will escape the edge of the scythe, and be lost. And if these cuttings are frequently repeated, the proportion that this under-stubble will bear to that which is above the scythe, must be at each cutting very considerable. And as the stems, when cut over, do not for the most part continue to advance afterwards, but die, and are succeeded by fresh shoots that spring up from the roots, all of these stubbles are entirely lost; which, in these circumstances, might perhaps amount nearly to one-half of the whole produce of the field; a great part of which would perhaps have been saved, if the field had been judiciously pastured upon. But if it can be kept firm on the surface, and smooth as a bowling-green, so as to suffer the scythe to cut close, perhaps more benefit would be derived from cutting than pasturage, as no parts of the field could escape the scythe, though it is well known that no art can make animals eat down the grass of a field quite equally, if it be not greatly over-stocked.

VI.

As the value of any plant, considered as a food for animals, varies greatly, according to the season of the year when it is in perfection—Wanted, A list of all the plants that could be most commodiously employed for food to each different kind of animal at each particular season:—That is to say, of plants that are in the greatest perfection in summer,—or autumn,—or winter,—or spring.



The variations that take place with regard to the growth of plants, at different seasons, have been hitherto but too little attended to by the farmer; so that were it not for the observations of the florist and botanist, we should be apt to think, that all plants were naturally disposed to vegetate chiefly in the summer-season; advancing always with a vigour in some degree proportioned to the warmth of that season, if not deprived of a due degree of moisture.

But the curious gardener knows well, that, however necessary the summer's heat
may

may be for bringing to perfection the greatest part of the plants that he cultivates, yet there are some plants endowed by nature with such particular powers of vegetating, as to grow with the greatest vigour, some at one season, and that alone, and others at another. Thus the common saffron-plant begins to advance towards the end of autumn,—shoots up with vigour during the winter, and, having attained its full length in the spring, gradually declines as the summer advances; and dies away entirely in the month of June, when the greatest part of the plants we rear are in full vigour. The snow-drop,—vernal crocus,—tulip,—narcissus, and many other bulbous-rooted plants, advance early in the spring, and decline before midsummer;—as also the common chickweed, lambs-lettuce, &c. Carnations, and many other late flowering plants, remain inactive during the beginning of summer, and only advance hastily towards perfection in autumn. The horse-chestnut-tree makes its whole annual shoots in a few weeks on the first approach of summer, and has entirely stopped its progress for that season long before the ash

or the oak have discovered the smallest symptom of vegetation: and this last, as well as the beech, after having made one short shoot in the beginning of summer, stops entirely for several weeks, and then, towards autumn, begins anew to vegetate, with much greater vigour than before.

Now, as we have remarked these variations in the season of vigorous vegetation in these plants, is it not probable, that something of the same kind may take place with regard to some of those plants that are, or may be cultivated by the farmer?—It would surely be of importance for him, to know all the peculiarities that take place, in this respect, with regard to the plants that it could be in his power to rear.

Some of these he is already, in some measure, acquainted with, and employs for his own emolument,—particularly the turnip; which only grows in a proper manner during the latter part of summer, in autumn, and in winter. He knows that rye-grass advances in the spring sooner than clover, or the greatest part of the other grasses that he has been accustomed to observe; with a few a other particulars

ticulars of that sort. But still so much remains unknown in this respect, as to be out of all proportion to what he is already acquainted with.

The plants that advance chiefly during the summer-season, and wither or die in winter, bear such a great proportion to the whole, that the farmer's chief desire should be to discover such plants as continue to vegetate late in autumn, or retain their verdure in winter, or advance very early in the spring: and it is probable that these are much more numerous than is at present imagined. Although I have not had an opportunity of prosecuting this subject as I could wish, the following hints may perhaps be of some use.

It would seem, in the first place, to be worthy the attention of the farmer, to examine all the evergreen perennial plants, with a view to discover if any of them could be easily cultivated, and profitably employed as food to any of our common domestic animals. Among these, it is well known that the common whin, furze, or gorse *, can be reared without any trou-

* *Ulex Europæus*.

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ble, and that it furnishes an exceedingly plentiful and wholesome food for sheep during the winter and spring. Nor is this plant less useful for horses or cattle, when it is properly bruised; in which state it is eaten by horses, in preference to the best hay or oats, and probably affords them as rich and wholesome nourishment:—and the finest winter-made butter that I ever saw, was obtained from the milk of a cow that was fed with bruised whins. Whether any other evergreen-shrubs might not, on some occasions, be profitably employed for the like purposes, deserves to be enquired into*.

But shrubs and trees are not the only evergreen-plants that we are acquainted with; as pinks, and many other garden-plants, not to mention cabbages and other greens, retain their verdure during the winter. All such plants, therefore, ought to be attended to with care, and accurate trials made of such of them as could be profitably cultivated by the farmer. Cabbages have been of late much praised as an inestimable winter-food for cattle;

* See note, page 17.

and

and although it is more than probable that the encomiasts of this plant are at present too sanguine in their expectations with regard to it, there is little room to doubt, that this, or some hardy kinds of borecole, may be found to be of real utility to the farmer, as a green winter or spring-food for cattle, on many occasions.

But it does not seem that any of our culmiferous grasses have as yet been suspected of being possessed of any quality approaching to this, in any degree: For, although it is well enough known, that common rye-grass, and many other sorts of grass frequently found in our fields and meadows, send out some fresh shoots during mild weather in winter, so as to assume a kind of verdure in rich grounds, in a very short time after the frosts are gone; yet it is as well known, that every leaf of this plant is quickly killed by any frost, and that the verdure we at any time perceive in these grasses during the winter-season, is always owing to a fresh vegetation from the roots. This happens to be so generally the case, that we have, perhaps with too much precipitancy, concluded, that it is universally so. I have

good reason to believe, that there may be several species of grasses whose leaves are only in part killed by cold, and some that resist the severest winters we ever have in this climate; without being more affected by it than our common ever-green shrubs and trees.

This seems to be in a particular manner the case with regard to the otherwise valuable grass called sheeps-fescue*, which first caught my attention by reason of the unusual verdure of a tuft of it which chanced to spring up in the midst of a field of other grass: And having since sown the seeds of it, I find, that this was not merely accidental; but that if it is allowed to advance before winter to a considerable length, the leaves retain their verdure during all that season, and might be employed at any particular period during the winter or spring, as a rich pasture to any animal that could live abroad during that season.--I had a small patch of this grass in winter, 1773; which having been cut in the month of August or September preceding, was saved, from that period,

* *Festuca ovina.*

and

and had advanced before winter to the length of five or six inches, forming the closest pile that could be imagined.—And although we had about six weeks of very intense frost, with snow, and about other six weeks immediately succeeding that, of exceedingly keen frost every night, with frequent thaws in the day-time, without any snow, during which time almost every green thing was destroyed, yet this little patch continued all along to retain as fine a verdure as any meadow in the month of May,—hardly a point of a leaf having been withered by the uncommon severity of the weather. And as this grass begins to vegetate very early in the spring, I leave the reader to judge what might be the value of a field of grass of this kind, in these circumstances.

Purple fescue grass * likewise retained its verdure much better than the rye-grass during the winter-season; but it had more of its points killed by the weather than the former. It likewise rises in the spring at least as early as rye-grass.

Vernal grass † seems likewise to resist

* *Festuca rubra.* † *Anthoxanthum odoratum.*

the winter-cold longer than many other grasses:—As does also the crested dogstail-grass*, which seems to be still more hardy than the vernal grass. But whether either of these can be considered as altogether ever-green, I cannot pretend as yet to say, not having had an opportunity of trying them properly by themselves.

Common rye-grass, as has been already said, is altogether incapable of resisting frost, and has its leaves killed down almost as soon as any other of our common grasses. And although it advances quickly in the spring, and furnishes abundant food as a pasture at that season; yet it has such an irresistible propensity to run to seed, that if it be not eaten down very close in the spring, so as to prevent its seed-stalks from ever getting up, it becomes in a short time disliked by all animals, and is at every other season of the year, if it has been ever allowed to push up its seed-stems, of little value as a pasture-grass.

Soft grass†, upon damp soils, is still more early than rye-grass; and forms a

* *Cynofurus cristatus.*

† *Holcus lanatus.*

pasture-

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pasture-grass, that may perhaps, in some respects, be very valuable.

All the tribe of *Poa*-grasses have their leaves entirely killed by a very slight degree of winter-cold—but they begin to vegetate pretty early in the spring.

But the earliest vegetable that I know, is the myrrh-plant * (wild cicely or cow-weed) which rushes up in the month of March with amazing rapidity; and may be cut twice at least, if not thrice, before red-clover could be cut once. Cows and other cattle eat it very greedily, after they have been a little accustomed to it; although they do not always take to it at first very readily.

It deserves to be remarked, however, that this plant seems to be chiefly valuable in the *spring*, as it seems to advance more quickly then, and during the first part of summer, than towards the end of it.—About autumn, its vegetative powers seem to be much abated.

In a few years, I shall be more able to speak with certainty of the qualities and

* *Chaerophyllum sylvestre*.

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best methods of cultivating this and some other plants, as it requires some time to bring experiments relating to them to a proper period *.

And the *epilobium*, or common willow-herb, may be employed for the same purpose, about the same early period.

Burnet † retains its verdure pretty well during the winter-months; but affords such scanty crops, as hardly to be worth the attention of the farmer.

All these grasses spring up early, and may be employed with most advantage as winter or spring-fodder. There are, however, others that do not make their appearance till late in the season, but on some accounts may be deemed very valuable. Of this class is the milk-wort, *vulgo* ‡, and all the class of perennial pease and vetches; which seldom appear above-ground till the month of May; but con-

* My experience since the above was written, tends strongly to confirm what is said in the text. The Myrrh-plant is a valuable article early in the spring; but towards the end of the season, it vegetates very feebly.

† *Pimpinella sylvestris*.

‡ *Astragalus glycyphyllos*.

tinue

tinue to yield a great burden of valuable grafs during the remaining part of the feafon, till the winter frofts flop them. If thefe, therefore, were fowed along with fuch plants as either ftand the winter, or advance early in the fpring, the farmer would have it in his power to reap the benefit of his early pafture for his cattle or fheep, without damaging his crop for the remaining part of the feafon ; as thefe would only begin to advance after the others were wholly confumed. And as moft of thefe plants are equally proper for being cut and made it into hay, or for being paftured upon, it puts it in the farmer's power to employ them in either of thefe two ways that may beft fuit his conveniency.

I have not as yet been able to difcover any plant that could be cultivated by the farmer, which advances only during the winter-feafon : but, as we yet know little or nothing with regard to this article, it is to be hoped, that future enquirers will make many valuable difcoveries relating to it.

VII.

SOME plants spring up quickly, and soon arrive at perfection ; while others advance more slowly, and are long in attaining maturity :—Some perish in a short time ; and others, when once well established, remain almost for ever without decay. It would, therefore, be necessary for the farmer who wished to improve his ground to the utmost, to be acquainted with the natural period of existence, if I may use that phrase, of every plant that it might be in his power to cultivate. Required—A list of plants considered in this point of view.



Naturalists have already established a few distinctions among plants in this respect ;—but these are by no means so far extended as the farmer would require. For almost all that they have done, is to reduce plants to the three general classes of annuals, biennials, and perennials ;—under which last head are arranged all those

those plants which endure more than two years. But the experienced farmer knows many plants which have but a short period of life, although they exceed this term. Broad clover usually lasts one or two years good; but seldom survives that period:—And rye-grass commonly lasts five or six years; but for the most part disappears soon after that time:—Sainfoin (*St. Foin vulgo*) lasts from twelve to twenty years;—as does also lucerne in a favourable soil; but both decline at last, and die away: whereas milk-wort, and all the classes of perennial tares and vetches, seem to be perennial in the most extensive sense of the word;—as no period can be assigned to their duration. This is probably the case with many kinds of meadow-grasses, although we are as yet so little acquainted with these, as not to be able to point them out with certainty.

VIII.

SOME plants grow best upon ground that has been lately in a tillage, and disappear after a short time, if it is not again ploughed

ploughed up; and others only begin to flourish after the ground has remained several years in grass. Required—A catalogue of all the plants that may be reduced to each of these classes.



Common couch-grass *,—knot-grass †, and earth-nut ‡, only appear while the ground is in culture,—or, at most, for a year or two after it has been laid into grass; after which they usually disappear, and are no longer seen till the ground has been again in tillage for some time. And it is in this way alone that the farmers, in some of the worst cultivated parts of Scotland, know how to get rid of these destructive weeds. This is likewise the case with the common small-leaved for-rell ||, mug-wort §, and some other plants that are often found in fields, that have been long kept under a bad kind of culture:—But these require a longer time to be fully eradicated, than some of the former plants. On the other hand, the

* *Triticum repens.* † *Avena elatior.* ‡ *Bunium bulbocastanum.* || *Acetofella.* § *Artemisia vulgaris.*

common milk-wort, yarrow or mil-foil, sheeps-fescue, and several other kinds of grass, only appear after the ground has been for some considerable length of time in grass.

IX.

Is it always the case, that those plants which fatten an animal most quickly, promote likewise in the highest degree the healthiness and vigour of that animal?—If they do not, Required—A catalogue of such vegetables as tend most powerfully to promote the vigour of such animals as are usually employed by man for hard labour; such as oxen, horses, &c.



Those who keep running-horses and fighting-cocks, seem to be fully convinced that great muscular strength, and vigour of spirit, are often promoted by certain kinds of food, that do not much increase the fat of the animal. In general, dry

food seems to be less apt to produce fat, than such as is more succulent; while it has a greater tendency to produce strength and vigour. Pease, and other leguminous * grain, have a greater tendency to increase the quantity of fat and juicy flesh, than oats; although this last is, seemingly with good reason, supposed to promote muscular strength in a higher degree.—In Arabia, where the inhabitants bestow a still greater degree of attention upon their horses than with us, they are said to feed them with a paste made of dates and camels-milk, which contributes to make them active and vigorous, without inclining them to grow fat.—In Portugal, it is common to feed their horses with chestnuts, as these are cheaper than barley or oats, which are found to fatten them very quickly, although it does not inspire them with so much life and vigour as those kinds of grain would have produced.—It is observed by Mr. Kalm, that in North America, horses are very fond of apples; but the inhabitants do not esteem

* Leguminous grain, is such as is inclosed in a pod or capsule, as pease, beans, vetches, tares, &c,

them

them a wholesome food.—Carrots have of late been proposed as a valuable feeding for horses; but it is not as yet well known in what class they ought to be ranked, with regard to the invigorating quality; although it is pretty certain that they fatten them readily.—Potatoes likewise have been employed on some occasions for the same purpose, and are still in the same state of uncertainty.—Turnips are eaten by some horses; but how far they are either invigorating or wholesome in other respects, is not sufficiently ascertained.—Bruised whins seem greatly to promote the health of this animal, at the same time that it fattens, and increases its strength.—But experiments are still wanting to ascertain, with precision, the comparative value, in this respect, of these and many other kinds of food, that may be given to this most useful animal.

X.

Do such plants as fatten an animal quickly, or tend in a high degree to excite strength and animal vigour, always

and necessarily promote its health, so as to tend to prolong the life of the animal? If they do not, Required—A catalogue of such plants as would, in the most effectual manner, tend to prolong the life of each species of domestic animals.

It would seem probable, that plants which tend too much to fatten the animal, would, in many cases, engender diseases that would shorten its natural period of life.—This seems to be pretty certainly the case with regard to sheep; as it is found that these fatten more quickly in rich vallies, which produce abundance of luxuriant succulent grass, than on higher ground, where the grass is drier and firmer; although they can be made to live to a much greater age on the latter pasture than on the former. And as it is probable the same thing takes place with regard to other animals, it might, on many occasions, be for the benefit of the farmer, to know with accuracy the distinction that takes place in this respect,

XI.

Some plants are noxious to one species of animals, which are wholesome and nourishing to others. Required—A list of plants that are poisonous to each species of domestic animals, arranged according to their degree of virulence;—distinguishing those that are more or less so at any particular season, and comparing the effects that each may have upon other domestic animals.



Long-leaved water-hemloc* is poisonous to cows; but wholesome and grateful to the goat.—Monks-hood† is pernicious to goats; but not at all hurtful to the horse.—Sheep, horses, and cattle are poisoned by the broad-leaved kalmia‡, which affords a grateful food to goats and deer. Parsley is deadly to small birds; while swine eat it with safety.—Pepper is mortal to swine, and wholesome to poultry; and poultry are killed by common salt, which tends to fatten cattle, sheep, and deer.

**Cicuta virosa*. †*Aconitum pyramidale*. ‡*Kalmia latifolia*.

Other plants which are not entirely poisonous, are, nevertheless, refused by some animals, although they are readily eaten by others.—Horses, cows, and hogs, refuse to eat the common ragwort*, which is greedily devoured by sheep, if they have access to it, in the beginning of summer, before the stalks are hardened.—Cows refuse to touch the meadow-sweet†, which is highly relished by goats.—Horses eat the water-mint‡, musk-thistle||, and many other aquatic plants, which cattle refuse to taste; and, on the contrary, horses refuse to eat angelica, loose-strife¶, geranium, &c. that are freely eaten by cattle.

The roots, the leaves, the stalks, the flowers, and seeds of the same plants, are very often endowed with medical qualities differing very much from one another; so that the same plant may be wholesome or pernicious, agreeable or disagreeable, to the same species of animals, at different periods of its growth. Lettuce, while young, is a mild, agreeable, and whole-

* *Senecio Jacobæa.* † *Spirea ulmaria.*

‡ *Mentha aquatica.* || *Carduus nutans.*

¶ *Lythymachia vulgaris.*

some fallad to man : But when it arrives near maturity, its stalks contain an acrid milky juice, that approaches to the nature of a poison. Young nettles and mug-wort are eaten as agreeable pot-herbs by the country-people, in the spring ; but, in a short time, they become rank in taste, and altogether unfit for that purpose.—Sheep greedily devour, and are nourished by, the ragweed when young, but reject it when full-grown.

Some plants, although equally noxious to animals when young, as when more advanced in growth, yet being then more tender, and less rank in taste and smell than they afterwards become, are sometimes eaten at that season, and prove fatal to the cattle that graze the fields where they abound, although they are rejected with care at other seasons. Linnæus remarks, that the cattle which pastured in the meadows near Torneo, in Lapland, died in great numbers in the spring, in consequence of eating at that season the tender leaves of *the long-leaved water-bemloc**, which they at other seasons care-

* *Cicuta virofa.*

fully avoided, and that therefore they then found the pastures found and wholesome.

The Yorkshire fanicle * is usually esteemed a poison for sheep; on which account, it has obtained its vulgar name, *rot-grass*. But sheep never bite the leaves of this plant, as any one may remark, who will carefully observe the plant at all seasons, on fields where sheep are allowed to pasture. But I have some reason to suspect, that they eat the flower and stalk; so that *if it is at all* poisonous to them, it is probably so at its flowering season. It grows on damp grounds, which usually produce other plants that are unfriendly to sheep, which may have helped to give this its name, as its leaves are more conspicuous than those of most other plants.

Numberless other plants are more palatable and nourishing to one species of animals than to another, or more or less wholesome or noxious to them at one particular period of their growth than at another. But as the farmer is not as yet in general acquainted with these, the loss

* *Pinguicula vulgaris*.

that

that is thus daily sustained by the public is very great ; so that it is of much importance to have this subject fully investigated*.

XII.

Are there any plants that tend to promote the generative faculty of animals, and render them more prolific than others? If there are, What are the plants that promote this in the highest degree, with regard to each particular kind of animals?



It is remarked by all travellers, that the animals in Egypt are in general more prolific than in any other part of the earth ; which is by them usually ascribed to the influence of the waters of the Nile ; although I would rather be disposed to believe, that some native plants of the country, joined to the mild temperature of the climate, tended to produce this effect.

* For the means of rendering some plants that are naturally noxious to domestic animals a nutritious food to them, see vol. iii. p. 590.

XIII.

ARE there any plants that have a natural tendency to excite animals to vengery at any season that they may be eaten?—If there are, What are the plants that produce this effect upon each particular species of animals?



Many reasons occur to make it appear probable, that there are some plants endowed with this peculiar quality: and although it would be of great importance to the farmer, on many occasions, to know these, yet, if any of them are at all known to some individuals, that knowledge is by no means so general as it ought to be.

Those farmers in England, who are in the practice of rearing house-lambs, are said to have it in their power to make the ewe take the ram at any season they may incline, by making them feed upon some plants they keep for that purpose, commonly said to be thyme, or some other aromatic plants. But, as I never had an opportunity

opportunity of being fully satisfied as to this fact, it is, perhaps, necessary to suspend our belief of it till it is duly authenticated *.

I have likewise been informed, that, in several parts of Scotland, the inhabitants are in the practice of pulling a certain plant that grows upon uncultivated fields, that they distinguish by the name of *bull-ing-grass*; a handful of which they give to their cows at any time they wish them to take the bull; which, it is said, never fails to produce the desired effect. But as I neither know if this fact can be certainly relied upon, nor the name of the plant, it were to be wished that some of those who live in the place where this is practised, would take the trouble of informing or undeceiving the public with regard to this circumstance.

* From facts that have come to my knowledge since the above was written, I am inclined to believe that more is to be ascribed to the *breed* of sheep, than any peculiarity of management. But this also requires to be proved.
Note to the fourth Edition.

XIV.

THE milk of domestic animals is of great importance to man; and, therefore, every particular that relates to it, ought to be examined with attention. And as it is well known, that some plants make the animals that feed upon them yield a greater quantity of milk than others would have produced—Required—An exact list of such vegetables as are endowed with this quality in the highest degree, with regard to each species of domestic animals.



Chickweed* is by many thought to cause cows to give an extraordinary quantity of milk.—Spurry, or yarr †, as it is called in some parts of Scotland, is thought by some to possess the same quality in an eminent degree; on which account, it is sometimes cultivated in Holland, as an useful plant, although it is here found to be a very pernicious weed. Cattle, indeed, prefer it, when green, to almost any

* *Alfne media.*† *Spergula.*

other

other plant; and sheep are exceedingly fond of it.

XV.

It is likewise probable, that some plants may tend to make the milk thicker, and produce a greater proportion of cream than others do. If this is so—Required—A list of such plants as produce this effect, compared with those that promote the quantity of milk.

XVI.

SOME plants communicate to the milk of the animal which feeds upon them, a very disagreeable taste; while others, on the contrary, give it a more pleasant flavour.—Required—A list of such plants as produce the one or the other effect, with regard to each species of domestic animals.



It has been often remarked, that cows which fed upon certain pastures, afforded butter of a richer and more agreeable taste

than could be obtained from other pastures; which would seem to be occasioned by certain plants abounding more in the one of those pastures than in the other:—Yet I have heard of no accurate experiment that has hitherto been made, to ascertain, with any degree of certainty, what were the particular plants that either tended to debase it in the one case, or improve it in the other.

It is, indeed, true, that the taste communicated to milk and butter by some plants, is so exceedingly strong and disagreeable, that no person could avoid remarking it. Of this kind are turnips, which communicate to milk a nauseous taste, that is extremely disagreeable to most people*.

Wild

* If the milk is to be used sweet, this disagreeable taste may be considerably diminished by boiling it. Other means of sweetening milk have been attempted, that are more troublesome and expensive, and not more efficacious.

It may be of consequence to remark, that, in general, that part of the milk which comes first from the cow when milked, is much more strongly impregnated with any peculiar flavour than what comes last; and as that is also the thinnest and least valuable part of the milk, it may be taken

Wild garlic, hemloc, and some other plants, likewise affect the milk with their own disagreeable flavours.

But

taken away, and applied to any other inferior domestic use, without diminishing, in any sensible degree, the products of the dairy.

By thus separating the first from the last drawn milk, the quality of the butter will be at all times very much improved, and the quantity hardly diminished in any sensible degree. For I have found, by experiment, that a small quantity of milk, which comes the last from the cow, contains about sixteen times more cream than an equal quantity that comes the first at once milking,—and that the cream is also of a much richer quality; the colour of the one being of a deep orange, while that of the other is as white as the paper on which I write.

Hence we may infer, by way of corollary, that no method of rearing calves can be so beneficial for a dairy, as that usually practised in the Highlands of Scotland, where it is the universal custom to allow the calf to suck its mother for some time, and then drive it away, and milk what remains in the cow's udder. By this means, the expence of milking is much abridged—the calves are suckled more kindly than by the hand—and the quantity of butter not much diminished: But the greatest advantage is, that the butter is thus rendered of the finest quality that could possibly be desired. It has, indeed, been often remarked, that well-made Highland butter is of the finest quality that can be found any where; but this circumstance, which contributes so much to its perfection, has, I believe, been over-looked.

It

But the most uncommon instance of this kind, that has come to my knowledge, was a case that happened to a widow lady of my acquaintance, whose cows, at one particular time, yielded milk that was so strongly impregnated with a peculiar kind of bitter taste, that no person could use it in any way; which surprised her a good deal, as the cows had often been allowed to pasture on the same field, without having had their milk sensibly impregnated with that disagreeable taste. Upon examining into what might be the probable cause of that singular phenomenon, it was discovered, that as the cows had been kept upon another field for some time before, the grass upon this field had been allowed to advance pretty far without being cropt. And as it was full of the rough-leaved dandelion*, which was then in full flower, it was imagined the peculiar flavour of the

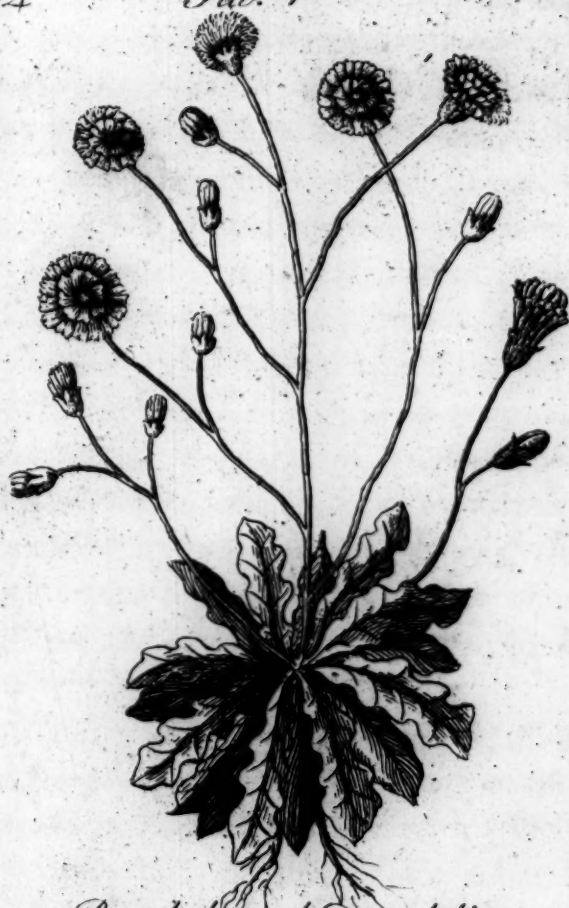
It deserves to be noted, that there is not near such a difference between the first and last drawn milk of an old calved cow, as of one that has but lately calved.

* *Leontodon hispidum*. This plant is sometimes called Hawkweed, and ranked by Botanists under the generic name of *Hieracium*.

milk

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Tab. 1



Rough leaved Dandelion

M. del.

milk was occasioned by the cows' cropping these flowers in greater quantities than at any other time; which appeared the more probable, as it was observed that this bitter taste was not perceived in the milk, after the cows had remained in that field for a few days, when the flowers of this plant were almost entirely consumed.

As I have not had an opportunity of trying any experiment, that could ascertain the truth of this conjecture, I would not desire that it should be relied upon as an undoubted fact; but from the circumstances above narrated, it seems extremely probable, that the flowers and flower-stalks of plants are sometimes endowed with qualities, in this respect, very different from those of the leaves; which ought to afford a lesson of cautious circumspection to the experimental farmer.

Although it is by no means certain that plants, in all cases, communicate the same flavour to milk, as that with which they affect our palate in their natural state, yet as we know that this sometimes

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happens, it may, perhaps, in some cases, assist us a little in discovering such plants as may probably affect it, either with an agreeable flavour, or the reverse,—serving, at least, to point them out as proper subjects for future experiments, intended to elucidate this point. With this view, having chewed, at different times, many different kinds of grasses that grow naturally in our fields and meadows, I was particularly struck with the agreeable aromatic flavour of the common vernal grass*, which seemed to approach so nearly to the rich almond-like flavour which is always observable in the finest butter, that I resolved to gather some of the seeds, and sow them by themselves, with a view to feed a cow for some time upon this plant by itself, to discover what effect it would have upon the flavour of the milk. The seeds are sowed, and are sowed; but it will necessarily be a considerable time before the result can be with certainty discovered †.

* *Anthoxanthum odoratum*.

† After trial, I found that this grass yielded such a scanty crop, as not to afford a proper quantity of provender to make the experiment.

XVII.

Some plants communicate to milk a rich yellow colour, and others render it pale, and almost colourless.—Required, a list of each of these classes of plants, with respect to all the different classes of domestic animals.



It is commonly imagined, that the butter which is of the deepest yellow colour, is also the richest in taste:—And although it seems probable, that this may be in general the case, and that many of the plants that answer the one of these intentions, may answer the other purpose also, yet it is by no means certain that these are not sometimes disjoined. For I have often met with butter of a very rich flavour, with little colour, and the reverse; so that it would be of consequence to the farmer, to have a list of the plants possessing these two qualities separately made out.

It is a vulgar prejudice, founded upon

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very inaccurate observations, that plants which produce yellow flowers, in general tinge the butter with their own colour; than which hardly any opinion could be more absurd. Yet, upon no better foundation rests the general prejudice in favour of pastures that abound with the butter-flower*, which has evidently derived its name from that circumstance; although more accurate observations show, that so far is it from being beneficial to cows, that they refuse to taste the plant, till they are reduced to the greatest distress by hunger.

XVIII.

Probably, some plants increase the richness of the milk, but do not produce a proportional quantity of cream;—some certainly make it afford cheese of a finer quality, and probably in greater quantities, than others. If so—Required, a list of such plants as produce the finest cheese, as well as of those that cause milk to yield the greatest quantity of it.

* *Ranunculus repens*,—*bulbosus*.



It has been often remarked, that if milk be of a very thick consistence, the cream is not so perfectly separated from it as if it were thinner:—That is, if water be added to it, more cream will be separated from it, than if it had got no mixture. But in that case, both the butter, cream, and whey, are poorer in quality, than if it had not been mixed: And as milk, naturally thin, is nearly in the same state, as thick milk when mixed with water, it seems probable, that if any plant tends to render the milk thicker, it will not afford an additional quantity of cream proportioned to the richness of the milk*.

But if this is converted into cheese, we may expect that it would afford a greater

* In the last note, I have taken notice of the difference between the first and last drawn milk. After the whole of the cream was separated from the last drawn, the milk that remained was thicker and richer, in every respect, than the cream of the first drawn. The milk of the first drawn resembled water coloured with milk:—that of the last was thick like cream; and the whey of it, when made into cheese, was richer than the milk of the other.

proportion of curd, and that of a richer quality: For goat's milk, which separates no cream, yields a very large proportion of curd, as well as the richest whey:—Sheep's milk, which is likewise thick, and separates little cream, comes next to it in both these qualities:—after these, in all those respects, comes cow's milk; and, last of all, the milk of mares and asses, which are thinner, and more watery than any of the others.

It may likewise happen, that some plants, which cause butter to have a very disagreeable taste, may probably yield cheese of an uncommonly agreeable flavour; as we require a more acrid taste in the last than in the first. This ought, therefore, to be attended to.

XIX.

It is imagined, that some plants may communicate to the flesh of animals that are fed upon them, a peculiar kind of flavour, which may be in some cases agreeable, and in others the reverse.—A list of the plants that tend to produce the one

or

or the other of these effects, would therefore be a valuable acquisition to the farmer.



Turnips are usually thought to communicate a slight kind of nauseous taste to the beef or mutton that has been fatted by them; and mutton that has been fed upon dry hills abounding with heather*, is commonly said to have a peculiarly agreeable relish: But the flesh of sheep that have been fed upon mug-wort†, is said to be of a bitter taste. The hogs that are fed upon the acorns that they gather in the woods of Germany and Poland, are reckoned to yield the finest bacon of any in Europe; and it is to this circumstance that most people ascribe the superior excellence of Westphalia hams, which have long retained their celebrity.—But the bacon of Virginia, where the hogs are fatted upon Indian corn, apples, and peaches, is by many deemed still superior to these;—and that which is fed

* *Erica communis.*

† *Artemisia vulgaris.*

upon grains or dairy wash, is reckoned much inferior to all of them.—But as it is not altogether certain, whether the difference in the quality of the meat, produced in these different places, is to be entirely attributed to the flavour communicated by the food, or if it may not, in some measure, be owing to the nature of the animal itself, or to some other circumstance not usually attended to; we must here, as in other cases, wish for a course of accurate experiments,

XX,

As many unsuccessful attempts have been made to introduce plants or animals from one country into another, and as some attempts of this sort have succeeded as well as could have been wished for, even when they were brought from very distant countries, it would be of use to the farmer, before he attempted any thing of that sort, to be made acquainted with the nature of the climate from which he intended to bring them, as well as the particular nature and economy of
such

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such plants or animals as he wished to encourage, that he might be able to give a probable guess, before-hand, whether such attempts could be attended with success or not,



The subject enquired into in this disquisition, may perhaps be deemed very uninteresting to the farmer ; and yet, upon a nearer inspection, it will probably be allowed, that had this been duly attended to by philosophical promoters of agriculture, many improvements might have taken place in this art, with which we are as yet entirely unacquainted ; and many unsuccessful attempts might have been prevented, that have tended to distress individuals, and, of consequence, to hurt the community : For, these unsuccessful attempts naturally tend to discourage others from trying experiments of the same kind, even where there may be a much greater probability of their being attended with success. The following hints, therefore, tending in some measure to remove this difficulty, however imperfect, it is hoped,

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will

will be received with indulgence by the Public.

Nature seems to have intended, that every climate should be peculiarly fitted to produce those substances that were best adapted to remove those diseases, or guard against the inconveniences, to which it was most exposed. Hence we find, that animals producing fur, chiefly abound in cold regions;—the closeness and fineness of the pile of these being always in proportion to the cold of the region they inhabit, or the rigour of the season in which they are caught*. Siberia, and the Northern parts of America, abound with animals that afford the finest fur, while hardly any of these are found in more Southern regions:—And the fur of the hare or rabbit is of much less value in the summer than winter-season, when the cold is more intense.—Hence we may in general conclude, that it is highly probable, that an

* I find reason now to doubt, if this fact be strictly just;—but as it does not much affect the general conclusion, and as it is not yet proved to be entirely unfounded, it is suffered to remain as it originally was written. *Note to the fourth edition.*

animal which produces a thick and deep fur, will bear to be transported from one temperate region to another, that is a little colder, without suffering much injury in its person, and probably to the melioration of its fur.

But as countries that are raised to a great height above the level of the sea, are extremely cold in proportion to others that are lower, it may often happen that a particular district, even in the torrid zone, may be in some cases colder than one in the frigid zone.—The Andes of America, even under the line, are constantly covered with snow ; whereas the heat at Torneo, in Lapland, is sometimes so intense, as hardly to be sufferable by man. Hence it may happen, that if a plant naturally grows, or an animal delights to feed in these elevated regions in equatorial climates, it may with good reason be supposed to be capable of being transported with safety to a much higher latitude, unless under particular circumstances.

To give an example of the use that may be made of these observations by the farmer.—Let it be remembered, that as
the

the wool of sheep is a particular and most valuable kind of fur, he has reason to suppose, that, like other animals of the same class, the sheep is naturally fitted for cold climates; and that its wool will be meliorated by any degree of cold in which the animal can be made to live, and will be made worse if it is kept in a warmer climate. Experience shows, that although sheep live in the West-Indies, yet, instead of wool, which they formerly carried in Europe, they there only afford a thin coat of long coarse hair, which again becomes wool after the sheep is brought back to Europe *.

Again—As the fleece is coarser that grows in a warm climate, or during the season of warm weather, than where it is colder, we may expect, that the finest fleeces will be produced upon such sheep as live all the year round in a cold region, where there is as little variation of climate as possible. On the Andes of America, where there is little variation of season,

* This fact also, though very generally believed to be undeniable, I have now very good reason to believe is unfounded. *Note to the fourth Edition.*

the wool, both of the sheep that were carried from Europe, and of their own native sheep called Lama, and its varieties, is extremely fine.—In Persia, where they drive their sheep to the cool mountains in summer, and bring them to the vallies only during the winter, and thus keep them during the whole year round in a cool region, their wool is remarkable for its fineness, even to a proverb: and in Thibet, a still colder country, the species of goat called Touz, yields a still finer fleece than the Persian sheep. In Spain, where a similar practice prevails as in Persia, it is well known, that they produce the finest wool in Europe. But in the Northern kingdoms of Russia, Sweden, and Denmark, where the sheep are exposed to violent heats during the summer-season, we do not find they have ever had such fine wool, as has been reared in the fore-mentioned places.—But, from our insular situation, which moderates alike the heat of summer, and cold of winter, Great Britain and Ireland enjoy a greater equality of climate, than any continental country in the same latitude can do; and
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are therefore naturally fitted to produce finer wool than any of these, with an equal degree of skill and care in the management of this most useful animal.

From the above induction, it would likewise seem probable, that the Lama, Guanacoe, and Paco, of America, which are never found in the low and warm regions;—the sheep of Persia, which constantly seek the cold mountains;—the goat of Thibet, and other animals of that kind, might be reared with success in the climate of Great Britain;—although it is probable that they might be much hurt by the summer heats of more northern or even continental regions.

On the other hand, these last-named countries are naturally fitted to rear some products that our insular situation would never permit us to cultivate with profit. Many persons who have been in Holland, Germany, or Russia, during the winter-season, where they experience a degree of cold far greater than is ever known in any part of Great Britain, fondly imagine, from this circumstance, that every plant which can be brought to perfection in these,

these, as they think, colder countries, could be equally well reared in Britain;— never adverting, that in the same proportion as their winter colds exceed our's, their summer heats are more intense. Hence we find, that vines can be reared on the Continent to great perfection, and come to maturity in many latitudes more northern than our's, although the many unsuccessful attempts that have been made to cultivate that plant in this island, afford the strongest presumption that it can never be done here with profit, unless on some very peculiarly favoured spot.

The bee is an insect, the active industry of which hath long been converted by man to his own emolument;—but with different degrees of profit, according to the nature of the climate that he inhabits.—Endowed with a degree of instinct, that, in some cases, seems to approach towards reason, this little animal, if transported to a Tropical region, where no vicissitude of climate is ever experienced; as it can there at all times find food in abundance from the flowers that constantly spring up around its habitation,

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is under no necessity of laying up stores for the winter ; and therefore lives from day to day on what it collects from abroad, so as to disappoint the hopes of the possessor of the hive, if he wishes to make profit of the honey that the bees may have provided *. But in Polar regions, where the rigour of the winter is so great as to prevent this delicate insect from obtaining any food at that season in the fields ; with a wise forecast, it fills its hive in summer with large store of food, to supply its wants during that rigorous season ; —which man greedily seizes for his own purpose. In vain, therefore, would the inhabitants of equatorial regions hope to make profit of this surprising insect, while those in a more northern climate may have a reasonable prospect of success.

But this is not the only respect in which the climate has an effect upon this industrious and delicate creature : For, as it is benumbed by a moderate degree of

* I have likewise learnt of late that honey of a very fine quality is produced in Jamaica, so that this beautiful popular hypothesis, seems, like many others, to have been adopted without sufficient examination. *Note to the fourth Edition.*

cold,

cold, without being deprived of life; if the country in which it is placed does not experience a degree of cold sufficient to produce this effect, while at the same time it is so intense as to kill the delicate flowers upon which it might feed, the animal is necessarily active too long; in which state it must eat: And having thus in a short time consumed all its stores, it must inevitably perish for want of food, before the approach of summer. But if the cold of the winter be sufficiently intense and constant, it remains during the whole of that season, in a sort of lethargic torpor; in which state it has occasion for much less sustenance of any sort, than when in a more active state: So that when it is revived by the returning heat of the spring, it finds abundance of food, still remaining in the hive, to keep it alive and strong, till the flowers spring up, and the season becomes mild, when it begins afresh the labours of the year.

Hence it appears evident, that the climate of the Continent, in which the heat of the summer and cold of the winter are alike uninterrupted, is much better adapt-

ed to the rearing this useful insect, than that of an island, where the heat in summer is less considerable, and the season more variable, and where the cold in winter is often interrupted by sudden gleams of heat, that frequently excite the bees to become active long before it is safe for them to go abroad in search of food. For which reason, the inhabitants of Poland and Germany have naturally fallen into the practice of raising great quantities of honey and wax, which many in Britain have attempted with far less success.—Nor can it be expected that in our climate, very great profits can be made of this insect; although it may be hoped, that in time the Northern colonies in America will avail themselves of the advantages that their climate will afford them in this respect, as soon as their country shall be sufficiently cleared of wood.

From not duly attending to the variations that necessarily take place between the nature of the climate of an extensive continent, and that of a small detached island, many have been disappointed in
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their hopes of rearing several American trees and shrubs in Britain; and have been much surpris'd to find them killed by our winter frosts, seeing they suffer every year, in their own climate, a degree of cold much more intense than we ever experience, without sustaining any damage from it.—But although the winter cold be there, indeed, much more intense than with us, it is likewise more invulnerable, and the season in every respect more constant; so that there, from the time that the vegetation is stopped in autumn, till it begins vigorously in the spring, the sap is never once put into motion:—whereas in Britain, the mild weather that we frequently experience in the middle of winter, very often swells the buds at that season, which gives them such a tender sensibility, as makes them unable to resist the severe frosts that often follow; so that they on this account perish with us entirely, although they were capable of resisting a much more intense degree of cold in their own native climate.

Many likewise have been much disappointed

pointed at finding the roots of certain garden-plants killed by the winter-frosts in Great Britain, which are seldom hurt by the much more intense cold that is experienced in Russia, and many parts of Germany, from whence we have endeavoured to introduce them, by not having sufficiently adverted to the difference of the two climates: For, as in these cold continental countries, the earth is constantly covered with snow, from the beginning of winter, till the genial heat in the spring melts it, the plants are by these means more effectually preserved from the intense cold, than by any other covering that we could give them;—inasmuch, that grass advances, and flowers spring up, under its protection, so as to appear in full blossom as soon as the snow is dissolved.

On the other hand, furze, broom, and heath, three plants which flourish in our climate, so as to become in many places a nuisance, cannot be preserved alive in Russia, without artificial cover; hence it is, that in those regions these plants are unknown. Even the hawthorn, which forms our hedges in the bleakest parts of Britain,

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is a green-house plant in Russia. For these shrubs, by rising above the snow, are thus exposed to the rigours of the season, and totally killed; while the more tender plants, of humbler growth, are so effectually screened by the deep mantling of Nature's robe, so liberally produced by the very cold, whose rigorous effects it was intended so powerfully to counteract, as to be effectually guarded from danger.

From these observations it appears evident, that we cannot in all cases promise that a plant will not be killed by cold in one country, although it should chance to be a native of one that is colder:—Neither can we always be certain, that a plant which comes to perfection in a temperate, or even polar climate, will meet with warmth sufficient to ripen its seeds, even in an equatorial region.—Thus wheat, barley, and other kinds of grain, that rush up with rapidity, and soon attain perfection in temperate climates, can hardly at all, or with great difficulty, be brought to ripen their seeds in the torrid zone.—For, in these last regions, although the heat of the day is very intense, yet

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the length of the night that constantly succeeds is so great, as tends much to retard the maturation of the grain :—at the same time the copious dews which these long nights always produce in warm climates, is so greedily imbibed by the succulent leaves of these plants, as endows them with uncommon vigour, to advance in length with the heat of the day ; so that the plants are urged on to grow to a prodigious magnitude. And it is so long before the ear begins to be formed, that before ever it can be brought to maturity, the tender stem becomes unable to support the vast load it has to carry ; and the rainy season approaches before the seeds can be ripened, which effectually destroys the whole plant.—But in regions that are placed nearer the Pole, as the day is so much lengthened during the summer season, the night hardly gives any check to the vegetation at that time ; and as the dews are necessarily less abundant, the plant has not such a tendency to an over-luxuriance of growth ; and the constant action of the sun soon disposes it to push out its flower-stalks, so that the seeds attain

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tain maturity with a rapidity unknown in these warmer climates.

Two countries that lie under the same parallel, and are in other respects alike, may yet differ from one another with regard to the production of certain vegetables, merely from the different form or position of these countries.—For if, from this circumstance, one of these places that may be compared together, should be more or less exposed to severe winds from any particular point of the compass, accompanied with rains, or the reverse, at certain seasons of the year, some particular vegetables may be benefited by this peculiarity, while others may be hurt or totally destroyed by it: Therefore some plants may be found to thrive very well in the one country, which would perish entirely, or languish in the other.

From this circumstance chiefly it has been remarked, that the climates of China, and of North America, resemble one another very much; and that the plants which flourish in the one, prosper equally well in the other;—these two countries being subjected to the same winds at the same

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seasons of the year, and to rains, cold, and heat, nearly at the same periods throughout the whole year.

From this cause likewise it happens, that the east and west coasts of Britain are not equally fitted for rearing the same kinds of plants to perfection. For as easterly winds prevail much during the spring months,—bringing violent rains, accompanied with sharp cold blasts, or thick muggy fogs, the vegetables that spring early, are so much affected by these on the east coast, especially in the northern parts of the island, as to languish or perish entirely;—while the same kind of plants, on the west coast prosper abundantly.

Hence, it is found, by experience, that the eastern parts of Britain, especially Scotland, are far worse calculated for producing fruit of any sort, than the western parts of the island; for, the tender blossom in the spring, is often nipped by these cold eastern blasts, or suffocated by thick fogs, when they escape on the opposite side of the island.—For the same reason, trees of any sort, or hedges, prosper better
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in general, near the west, than the eastern shore.

On the other hand,—from the violent and almost continued rains, that fall during the summer and autumn, on the western coast, while that of the east enjoys a clearer sky and warmer sun, the first is much less fitted for rearing abundant crops of corn than the last.—Their harvests are later, and more precarious.—Their fruit, although more abundant, is less perfectly ripened; and the country is better calculated, in every respect, for grass or wood, than for crops of grain.

Their winters are also less severe,—the snow lies for a shorter time,—the summers more moderate in their heat; and the variations between the different seasons are far less perceptible, for reasons that are so obvious as need not be particularly pointed out.

By properly attending to these peculiarities of different climates, and to the nature and particular economy of the plants or animals that he wishes to rear, a man may have a tolerable guess whether or not he may hope for success in rearing plants

plants in one country that are brought from another.—Thus, it will readily occur to any person in the least conversant in this subject, that it would be in vain to expect to be able to rear any of the trees peculiar to equatorial regions in the open air, within or near the Polar circle: Because, as there is little variation in the heat of different seasons in the first-named regions, it is probable that such perennial plants as are natives of them, would be incapable of bearing any considerable degree of cold, which they cannot fail to meet with in the last-named regions; so that there is the greatest reason to think they would all be killed at the very first approach of winter.

But there is not so much reason to despair of being able to rear to perfection, in high latitudes, some annual plants that may be natives of equatorial countries. For, if these plants require but a short time to attain perfection in their native climate, it is not at all impossible but they may ripen in the other, during the summer-season, before the cold weather of autumn approach to kill them. And accordingly

cordingly we find, that several annual flowers from these regions have been introduced with success into our gardens; and probably other useful plants, if equally attended to, might have been cultivated by us with equal success.

The potatoe, which has of late been reared with such happy success in all the northern parts of Europe, sufficiently evinces the justness of this remark; for, it is a native of a very warm climate, and is as impatient of cold as almost any plant we know:—Yet, as the length of our summer sufficeth to bring it to perfection before the frosts approach, we are enabled to cultivate it with the greatest advantage. Whether the yam, another West-Indian root, nearly approaching to the nature of the potatoe, could be reared with the same facility in Europe, seems to me a little doubtful, as it requires a longer time to arrive at perfection in the West Indies than the potatoe. But it is probable, that many plants whose value consists in their leaves, and not a few whose roots or seeds are most esteemed, could on, some occasions, be introduced, with

with success into Europe, or the American continent, were the peculiarities of their growth duly pointed out, and sufficiently attended to.

But it is not in all cases enough for the farmer to know, that plants will live in the country he inhabits. Before he attempts to rear them, it is likewise necessary that he should know, if his situation is such as, with an ordinary degree of care, puts it within his power to attain all those peculiarities that seem to be necessary for the well-being of that particular plant he means to cultivate. For a diversity of climate often produces a much greater variation in this respect, than most people seem to be sufficiently aware of.

Thus, in warm countries, such as Portugal, Spain, and Italy, the heat of the sun becomes so intense during the summer-months, that all the common superficial fibrous-rooted grasses are totally destroyed, so that the common pasture-grasses are withered, and the fields become bare and parched up at that season, unless where artificially watered; inasmuch
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that the inhabitants are often, from this cause, subjected to great inconveniencies for want of food to their bestial. It was therefore an object of the utmost importance to them, to discover a plant, that could be made to live and thrive at that particular season, and furnish an abundant and wholesome food to their domestic animals.

Such a plant they have happily discovered in the Lucerne; which, by sending its roots to a great depth in the soil, continues to find there, moisture sufficient to preserve it in a degree of vigorous vegetation, when all the common grasses are totally destroyed. No wonder, therefore, that the inhabitants of these countries should consider this as one of the most valuable blessings that Heaven, in its abundant bounty, hath bestowed upon them, and never have done with its praises. —But, in our more temperate climate,—as we do not stand in such need of a plant of this sort, so neither do we find ourselves in a situation that admits of the culture of it with so much advantage. For here the moderate heat of our summers,

mers, and the frequent gentle showers that we then have, are so exceedingly favourable to the growth of the common fibrous-rooted grasses, that every unoccupied spot becomes quickly covered with them; and they spring up so close upon one another, as to choak every other plant that is not so hardy and luxuriant as to overtop and destroy them.—Now, although it is found that the Lucerne plant will live and thrive extremely well in our soil and climate, if it be kept free from these numerous weeds; yet it is by no means capable of destroying, without assistance, that immense quantity of grassy plants which constantly spring up around it here, stint it in its growth, and at length totally destroy it, unless we are at pains to free it from this its most destructive enemy. This adds very much to the trouble and expence of cultivating the plant in our climate, and prevents us from having it in our power to rear it with success, in that easy promiscuous way of sowing it, which may with safety be practised in those climates where Nature performs the part of the gardener, and frees it
more

more effectually from this particular weed, than any care or trouble with us could ever effect.

XXI.

Is there any method of preparing the food of animals, so as that it may be made to afford them a better or more abundant nourishment than in its native state?—If there be, What are the rules that ought to be observed in this respect, with regard to every species of aliment that may be thus improved, as applied to each species of domestic animals?

As several plants that might be employed as food for domestic animals, are of a texture too firm to admit of being easily chewed by them; whatever tends to reduce them to a finer state, may probably be of use.—Thus, before furze can be properly given either to horses or cattle, it is necessary to reduce them to a sort of pulpy state, by bruising them.—Straw, on account

count of its toughness, is the better for being cut ;—and probably it is chiefly on account of the facility with which the animal can chew it, that it affords a more abundant nourishment in this condition than in its native state.—Oats are firm and smooth, and are therefore in danger of being swallowed whole, if given by themselves, and thus passing through the animal without benefiting it in the least ; to prevent which, some mix them with chopt straw, and think they derive very great profit from this practice :—But others have of late fallen upon perhaps a better method of effecting this purpose, by making the oats pass between two smooth rollers set close upon one another, like those employed for bruising malt ; which reduces them to such a state, that, with very little manducation, allows the whole of the nourishment that these can afford to be extracted in the stomach of the animal.—Slicing of turnips may likewise be of use in this respect ; but mashing or bruising them, so as to reduce them to a kind of pulp, would answer this purpose

pose much more effectually, and could be performed with much greater ease.

But besides this mechanical sort of comminution, which may be attended with some advantages, on many occasions, it is probable, that many kinds of food might, by other operations, be rendered more wholesome or nutritive to particular animals. The experience of man, with regard to his own food, sufficiently demonstrates, that the qualities of almost every species of vegetable aliment are considerably altered by coction, or otherwise readying by means of fire; and as their qualities are thus changed from what they were in their native state, it is to be supposed they might, on some occasions, be rendered more nutritive for certain animals, after having undergone some culinary process *, than in their crude state. Accordingly, we find, that many farmers adopt this practice with regard to particular substances.—Beans and pease are oftener boiled, than given raw to horses;—and when

* Culinary process is a general term, for denoting any operation performed upon aliments by the assistance of common fire.

cattle are fatted with this grain, they are almost always given in this state. Hay, when mashed with warm water, or slightly boiled, is reckoned much better for cows, than in its dry state.—Potatoes, when given to horses, are usually boiled;—and it has been alledged, of late, that hogs are fatted much more quickly, and to greater perfection, on this root, if roasted, than if it were either boiled, or given in its crude state.—But in all these cases, different persons are of different opinions;—nor do we as yet know that any *decisive* experiments have been tried, so as to ascertain, in a *satisfactory manner*, whether these practices are really beneficial to the farmer or not; or the exact degree of profit or loss that he would in any case sustain, by following the one or the other of these practices.

It is likewise possible, that certain plants may, on some occasions, be meliorated by other processes. The cassava root, by being steeped in water, and afterwards hard pressed, is changed from a very poisonous substance, into a very nourishing food for man.

man. All farinaceous* kinds of grain, by malting, are converted into a saccharine substance, capable of being fermented, which they were utterly unfit for before:—And as it is well known that nothing is so nourishing or fattening to animals in general as saccharine juices, it is not impossible but that by this operation some of these might be considerably improved as a food for some of the domestic animals.—Other methods of improving vegetables, in this respect, may, perhaps, be discovered; that have not as yet been thought of.

XXII.

Is there any way of compounding different kinds of food for domestic animals, so as that their effect, when thus compounded, shall be greater than if they had been administered separately?—If there is,—What are the kinds of food that may be in this manner improved, or have their

* Farinaceous is a general term denoting all such vegetables as afford a meally-like substance; as wheat, oats, barley, rye, pease, &c.

virtues increased, by being given to an animal along with others?—The manner in which they ought in these cases to be administered?—Whether they ought to be mixed together, or given separately?—What are the most advantageous proportions of each; or, in what order of succession ought they to be administered to each species of animal, so as to produce the greatest effect?—or, are there any kinds of food, that, by being given to any domestic animal mixed together, or in immediate succession, tend to produce a contrary effect, by yielding to the animal, in this manner, less nourishment than if they had been given separately?—What are they?



Physicians affirm, that the effects of different kinds of medicines upon the human frame, are increased or diminished if given along with others:—Nor is it at all improbable, that this may be the case with different kinds of food upon brute animals; although our observations have not yet been sufficiently accurate with regard to
I . them,

them, as to have enabled us to remark, with any degree of certainty, if this really is or is not the case.—Yet it is generally imagined, that oats given to horses along with grass or any other green food, are less beneficial to them than at other seasons.—Experiments here are much wanted.

After these remarks had been published more than twenty years, I learned that the leaves of the yew-tree, which is a strong poison to horses and cattle, by being mixed with oats, becomes perfectly innoxious, and that in the province of Hesse, in Germany, the peasants actually feed their cattle on the leaves and twigs of the yew-tree through the winter; its noxious quality being destroyed by having a proportion of dry food administered along with it. See vol. iii. p. 590.

XXIII.

Are there any substances, which by being employed by way of condiment along with the food of animals, would tend to make that food produce a greater effect than if

it had been given alone?—If so, what are they,—and how ought they to be most efficaciously employed, with regard to each species of animals?



It is pretty certain, that common salt is, on many occasions, agreeable to animals in the state of nature ;—nor is there much doubt but that it may be often administered to domestic animals with success ; which, probably, acts in no other way but as an agreeable condiment, that may prepare the body to receive the full effect of the food that is given along with it, help the digestion thereof, or make it be eaten with a more agreeable relish.—In North America, there are found, in many places, strata of earth impregnated with saline matter, which the deer and other wild animals discover of themselves ; to which they frequently resort, to lick the saline earth with their tongue. If a huntsman discovers one of these *licks*, as they are there called, he never fails to make profit of it, by concealing himself near the place, and shooting the animals that come successively

ſucceſſively to gratify their palate with this agreeable refreshment.—In Spain, and many parts of France, they give to their ſheep a conſiderable quantity of ſalt, which they imagine tends both to fatten and preſerve them in good health; but it is ſaid, they do not find it neceſſary where the ſheep feed upon chalky or lime-ſtone paſtures.—In England, it is well known, that animals fatten more quickly on ſalt marſhes than any where elſe.—From all theſe circumſtances, it would ſeem probable, that common ſalt is, in general, an uſeful condiment, and might poſſibly be employed, on many occaſions, with profit, in feeding domeſtic animals.

Other ſubſtances that promiſe to be equally efficacious in this reſpect, have not as yet been attended to.—Nor have the effects of this ſubſtance been aſcertained with any degree of precision *.

XXIV.

Is there any method of treating animals, in general, ſo as to diſpoſe their bodies to

* See this ſubject more fully illuſtrated, vol. iii. p. 551.

imbibe a greater degree of nourishment from the food that is given them, than they would have done if managed in a different manner?—If there is, what is the most proper method of treating each species of domestic animals, considered in this point of view?



It is in general allowed, that frequent and moderate bleeding of any animal, put up to feed, disposes it to fatten more quickly than it would do if that were omitted. It has been likewise often observed, that keeping cattle dry in winter, and in a moderately dark place, tended much to produce the like effect: But it seems to be of still greater consequence to keep them in an equal temperate warmth, which, on many occasions, will operate as much as a considerable quantity of food would do without it.—But what is the most proper degree of heat for each species of animals, has not as yet been attempted to be ascertained.—Currying or combing some animals, likewise tends greatly to promote their health, and bring them forward
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in feeding, particularly the horse; but how far it might be beneficial to others, hath not yet been enquired into; though an opinion now begins to prevail pretty generally, that it is highly beneficial for cattle. Castration of males tends to ameliorate their flesh, and to make them fatten more quickly: And it is in general observed, that females when young, fatten more quickly than at other time; but how far they may be allowed to advance in their pregnancy before it becomes detrimental, requires as yet to be enquired into. It is a fact also, that is pretty well ascertained, that sheep which are infected with the disease called *the rot*, are disposed to fatten more quickly than others, during the fore part of winter; but unless they be killed before the spring approaches, they are infallibly lost.

XXV.

Does that mode of treating any animal which tends to make it fatten quickly, at the same time tend to increase the quantity of milk?—If there is any difference

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rence in this respect, wherein does it consist, as applied principally to cows and other domestic animals, that are chiefly of use to us on account of their milk?



It would seem probable, that the same mode of treatment would often answer both of these purposes, although there is some reason to think they may not in all cases coincide.—Warmth in winter, causeth cows to give more milk, as well as fatten more quickly, than they would do if deprived of it.—The same may be said of proper dryness, cleaning, &c. But it is universally allowed, that bleeding a milch-cow, tends to diminish the quantity of milk, though it is thought rather to forward its fattening; the milk also gradually decreases in quantity as their pregnancy advances, till they are very near the calving.

Whether salt promotes the quantity of milk, in the same proportion that it tends to fatten, will probably be known by those who have had the experience of salt-marshes.

XXVI.

Does a difference in the nature of the pasture or food of the animal, produce any change upon the *quality* of the wool of sheep, or the hair of other animals, independent of other circumstances?—If it does, what are the changes produced by this means?



It is in general believed, that particular pastures are peculiarly favourable for producing fine wool; and that improvements by clover and other artificial grasses, tend to improve the quality of this valuable commodity;—although it seems to me by no means certain, that this fact is so well established by experience, as to deserve to be implicitly relied on.—The countries which produce the finest wool, do not always afford the richest pastures.—Neither the mountains of Persia, nor those of Spain, produce grass nearly so rich as many parts of Europe, which afford wool of a much inferior quality.—In England, the pastures of Southdown and Leominster, have

have nothing peculiar to themselves that may not be met with in many other parts of this island ; so that we may justly doubt if it is owing to this circumstance, that the wool of those places has been so long distinguished for its superior quality above that of other parts of the country.—It is not more than a hundred years, since it became common to cultivate clover and other artificial grasses in Britain ; and we have no reason to think, that the quality of our wool has improved since that time, but rather the reverse.

Neither does it seem at all probable, that richness of pasture tends to debase the quality of the wool,—seeing the sheep of Lincolnshire, of the Isle of Wight, and of Romney-marsh, which feed upon rich deep grass, yield fleeces of an exceedingly fine quality ; although the fine sheep of Buckinghamshire, that feed upon equally rich pastures, and become as fat as any of these, always afford wool of a much coarser quality.—But, whatever effect the nature of the pasture may have in altering the fineness of the pile of the wool, there seems to be little doubt but that abundance

bundance of food is necessary to give it its full strength and firmness; as it seems to be universally allowed, that a very lean sheep never yielded a fleece of wool of the very best quality, with respect to strength and softness, whatever may be the case with regard to fineness of the staple. This subject is of much importance, and deserves to be fully investigated.

XXVII.

Does the nature of the climate alter the quality of the wool of sheep?—If it does, What are the changes produced by this means?



It is a prevailing opinion with many, that fine wool can only be produced in mild climates, rather approaching to warmth than the opposite extreme; which has, in like manner, in all probability, been adopted precipitately, before the subject was duly investigated.—Reason would make us rather expect that the contrary would be the case; and experience seems
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to confirm it, as appears No. XX. p. 72, to which I refer the reader. The subject is of great importance, and, therefore, ought to be discussed with all the coolness and circumspection imaginable.

XXVIII.

Does the fineness, or any other quality of the wool, vary with the age of the sheep?—Or, is the weight of the fleece increased or diminished by a difference in this respect?



The price of wool is so low in Britain, and the value of the fleece here, bears such a small proportion to that of the carcase, that less attention has been bestowed to the circumstances that may vary it, than the importance of it, to the country in general, would seem to deserve;—we have, therefore, so few opportunities of seeing old sheep, that our experience can only furnish grounds for slight conjectures on this head.—Probably, more satisfaction could be obtained from Spain than
any

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any other country at present, with regard to this and the other disquisitions relating to wool, as it has been long a staple commodity with them, and almost the only vendible produce of their flocks; so that it must necessarily have claimed a great share of their attention.—It seems, however, to be, in general, allowed, that the weight of the fleece diminishes with the age of the sheep, after a certain period.

XXIX.

Is there any mode of management that would tend to make a greater *quantity* of wool be produced upon the body of the same sheep, than there would have been if it had been treated in another manner? —If there is, what is it?



The French have of late bestowed a very particular degree of attention upon their woollen manufactures, and have spared no pains to meliorate their wool, and improve their breed of sheep. By an
• experiment,

experiment, conducted under the direction of the Intendant of Normandy, with this view, it appears, that sheep which are kept all the year in the open air, yield fleeces about one-fourth part more weighty than the same kind of sheep which were kept at night, and in bad weather, under a covered fold; and the wool of the first was likewise of a much better quality in every respect.—Whether any other mode of treatment tends to produce a similar effect, deserves to be enquired into.

XXX.

Can the quantity or *quality* of the wool be improved or debased by any particular mode of managing the sheep, or by applying any particular substances to the skin of the animal, while the wool is growing?—If it can, what are the circumstances, or the substances, that produce this effect?



In every sheep-country, there are many *nostrums* and particular recipes handed about, or generally adopted, which are believed to contribute to the improvement

ment of the wool in some of the ways above mentioned. But these are, in many cases, so evidently useless, and seem, in general, to have been adopted with so little reason, that an enumeration of such of them as may have come to my knowledge would be only tiresome to the reader ; for which reason they are here omitted.—A judicious experimental philosopher, however, who would investigate this matter in a proper manner, and elucidate the subject by decisive experiments, would do an essential service to his country ; as, in all probability, our future success in the woollen manufacture will depend upon our attending more particularly to the article of wool, than we have done for more than a hundred years past ; during which period, there is very great reason to suspect, that the quality of the wool in England, instead of growing better, has become sensibly worse, while that of our neighbours on the Continent has been greatly improved*.

* See Observations on the means of exciting a Spirit of National Industry, Lett. IV, V, VI, VII, and VIII, where all the above questions relating to sheep and wool are particularly illustrated.

XXXI.

AT what age can animals of each particular class be fattened, with the greatest facility? and at what period of life is the meat of each kind in the highest perfection, supposing it to be equally fattened?



While animals are young, and growing vigorously, as a great proportion of the food they eat goes towards increasing the size of the body, it is natural to expect that these will be with more difficulty brought into full fatness, than those which have previously attained their full stature; but if the flesh of these young animals is much esteemed, it may often happen, that the owner of them may have more profit by feeding them even under this disadvantage, than by keeping them till they attain their full maturity. It, therefore, becomes a question in rural economics, in what cases the one or the other of these modes of feeding ought to be adopted? which

which could be the easier solved, did we know exactly what was the proportional difference of the expence of feeding different classes of animals in each of these cases.

With regard to the last part of the query—It is sufficiently well known, that young mutton is never so agreeable to the palate, as that which hath attained to full maturity; but how long it continues to improve, does not seem, as yet, to have been so fully ascertained as it ought to be. There does not seem to be nearly such a difference between young and old beef or pork; and therefore the farmer is, or ought to be, under less restraint with regard to these.

XXXII.

Do different classes of animals require an equal quantity of food in proportion to their size?—If there is any difference in this respect, what is the exact amount thereof, with respect to each particular species of domestic animals, when compared with others?



It is certain, that if we compare very different orders of animals with one another, we will discover a prodigious difference in this respect.—A caterpillar will consume in a day more than double its own weight of food, while the chameleon would be sustained for months upon a like proportion of food: The camel is likewise believed to require a much smaller quantity of food, in proportion to its size, than almost any other quadruped.

But, to come to those in which we are more nearly interested, it is universally believed, that a horse requires a greater quantity of food to sustain it, than an ox of the same weight: But I have never yet heard of any experiment that has accurately determined what is the exact proportion in this respect. Common opinion seems to place it at different proportions; sometimes rating the horse at double the ox, and sometimes at only one-third more. For, in many parts of the country, the price of the summer-food of an ox, is precisely

cifely one-half of that of the horfe; but, in other places, the difference is only as four to fix. Whether either of thefe is exact, or which of them is neareft, the truth, deferves to be afcertained with precision: But, as the opinion is fo univerfally prevalent, that the horfe requires a greater quantity of food in proportion to his fize than the ox,—the probability is, that he really does fo.

As the other kinds of domeftic animals differ more in fize from one another than thefe do, it is not fo eafy to make a comparifon between them; but as it is poffible they may vary confiderably from one another in this refpect, the farmer muft remain very much in the dark with regard to a very effential branch of his bufinefs, till this be determined with precision.

XXXIII.

We obferve, that there are a great many varieties of each particular fpecies of animals, that are diftinguifhed from others of the fame fpecies, by certain peculiarities

which are, on many occasions, easily perceptible. These varieties among the brute animals, have been usually distinguished, among farmers, by the appellation of different *breeds*, as they have supposed that their distinguishable qualities are at least in a certain degree transmissible to their descendants; although Naturalists, overlooking these distinctions, consider each of these breeds as only an accidental variety of the individual, which hath little or no influence upon their progeny.—Query, therefore, whether these different *breeds*, as they are called, of any one class of domestic animals, is really a distinct tribe, endowed with the power of transmitting to its posterity all its distinguishing properties, so long as it is prevented from intermixing by copulation with other breeds?—or, are the varieties that we perceive, in this respect, to be attributed to accidental causes alone, and not immediately depending upon the nature of the parent animal?



We would imagine, that in a case of so much importance as this we now treat of,

of, with regard to which, mankind have had so many opportunities of trying experiments, and making particular observations, there could have remained no room to doubt, long before this time. But although science, in general, tends to improve knowledge, on some occasions it rather confounds and perplexes the understanding. For when we find that the systems we have invented, are incapable of explaining all the phænomena that occur, we are but too ready to despise, with a fastidious pride of mind, those phænomena that would perplex our system, and hastily to say, they owe their existence to inaccurate observations alone.

This seems, in a particular manner, to have been the case in the present instance. And although it is impossible for any reasoning to get the better of daily experience, so far as to make a man believe directly the reverse of what he sees with his own eyes; so as that nothing can convince the farmer that the nature of the animal from which he breeds will not have some influence upon its progeny;—yet it has so far prevailed, as to induce

almost every farmer to believe, that, unless in the particular cases which have occurred to himself, all the other varieties observable in the breeds of animals, are either entirely occasioned, or much influenced, by peculiarities of soil, food, or climate. So that in no instance do we meet with such an unaccountable discordance between general opinion and particular practice, as in this very case.

That all the qualities which serve to distinguish particular breeds of animals from one another, can, in some cases, be transmitted without alteration to their posterity, for ever, if they are carefully kept from copulating with other breeds of the same kind, seems to be fully demonstrated by what we observe with regard to dogs; the different varieties of which are endowed with such remarkable peculiarities, as to serve to point out the particular breed with so much certainty and facility, as makes it impossible for any one not to perceive at once if the breed has been debased: And our experience with regard to them is so universal, as to leave no room for the most ignorant to doubt, that
all

all the varieties of these that we meet with, inherit from their parents, the peculiar distinguishing natural talents that they possess ; and that these are in no case to be attributed to any diversity of food, or any other circumstance whatever.

The same thing is also, in a great measure, remarked with regard to the horse ; —although the different varieties of this animal are not so distinctly marked as those of the dog-tribe ; and, therefore, the proofs of the fact in dispute, are not so palpably evident as in the other case. Yet we would surely laugh at the absurdity of that man, who should hope to rear a large-boned weighty dray-horse, by breeding with a fine Arabian mare and stallion ; or, who would expect to have a light-running horse from a father and mother of the dray-breed, let him feed them in whatever manner he may incline. And although the different breeds of horses are almost infinite, and few of them so much different from each other, as in the above example ; yet, it is observable, that the prevailing breed in any one district, always continues of the same kind, so long
as

as the inhabitants of that district continue to breed from them, whatever alterations they may make in the general culture of the country, and nature of the pastures. Nor do these horses ever alter their qualities, if they are carried to another district, where another breed, of very opposite qualities, in general, prevails, but each retains its distinguishing qualities to the last, although they should continue to eat the same food, and be treated, in every respect, alike, to the latest hour of their lives.

Nor is the case in the least different with regard to cattle, sheep, and hogs,—and perhaps all other animals. For, let a hundred different breeds of either of these kinds of animals be brought from as many different places, and fed upon one common pasture as long as you incline, each of these will continue to preserve every mark of distinction from all the others, so long as it lives.—But if they are allowed to breed promiscuously, the progeny would necessarily be a mongrel breed, participating of the nature of each
of

of the parents who should have contributed to produce them.

Many other arguments might be adduced to show that we have the greatest reason to believe, that each particular breed of other animals propagates its own kind with as little variation as is acknowledged to be the case with dogs, so long as they remain unmixed with others. But these, to avoid prolixity, I omit.—I could not, however, avoid throwing out these observations on a subject of so much importance; as the erroneous opinions that have so long prevailed with regard to it have been in some cases attended with consequences highly detrimental to the community*.—If these hints shall induce others to examine the subject with attention, I shall be perfectly satisfied.

* See this subject more particularly illustrated, in the first appendix to Dr. Pallas's account of Russian sheep, published by the author; and in *Observations on the Means of exciting a Spirit of National Industry*, p. 123,—130. *Note to the fourth Edition.*

XXXIV.

If different *breeds* of domestic animals do, on many occasions, possess particular qualities, that differ very essentially from those possessed by other breeds of the same class of animals; and if these qualities are transmissible to their posterity, without alteration, so long as the breed remains unadulterated by an admixture with others; it will be a matter of the utmost consequence to the farmer, to be well acquainted with the nature and distinguishing qualities of every particular breed of all those animals that he may have it in his power to rear, that he may thus be enabled to choose only that particular breed which possesses, in the highest degree, those qualities of which he means chiefly to avail himself.—Wanted, therefore, an exact list of all the various breeds of domestic animals, with a particular specification of all those qualities for which each breed is peculiarly remarkable.

There

There seems to be great reason to believe, that the several breeds of domestic animals differ more from one another with respect to some of those qualities that may make them more or less valuable to the farmer, than is in general apprehended at present. The gentlemen of the *turf* and *menage* talk with the utmost confidence of different degrees of vigour, persevering strength, hardiness, and even mental qualifications, if I may use that expression, of the different breeds of horses. Those of Spain are much prized, as well for their external beauty, as for their judgment and memory. The barbe is deemed naturally more indolent; although he is capable of as high exertions either of body or mind, when obliged to it, as almost any other:—being, in an especial manner, capable of continuing in any violent exertion much longer than most other horses, although the Arabian courser is by some thought to possess these same qualities in a still higher degree.— All of these

these require to be nourished with care, and treated with the utmost circumspection. On the contrary, the horses of Denmark and Friesland are said to be stronger and more hardy,—live upon any fare, and are hurt by no sort of bad treatment.—The Neapolitan horses are large and showy; but are incapable of any violent exertion, and are soon exhausted if they are much put to it.—The same qualities are remarked in many of the large-boned showy horses in England; on which account, those only are by the connoisseurs deemed capable of undergoing the violent fatigue of hunting, racing, &c. which have, in the jocky style at least, *some blood* in their veins. By which is understood, that they are descended, either by the father or mother, from an Arabian, Persian, Turkish, Spanish, or Barbary horse or mare: All of which are supposed, in an eminent degree, to possess great muscular strength and length of wind.

But, besides these more remarkable distinctions, there are many other varieties of this useful animal, reared in different
parts

parts of this island, and only employed for draught and other useful services, that are well known to differ from one another as much in their degree of hardiness, or *mettle*, as it is sometimes called, as in their external form and appearance.—Some of these are of such enormous bulk and strength, as to drag slowly after them the load of an elephant, but are utterly incapable of any violent quickness of motion.—Others are naturally endowed with greater agility, and less bodily strength as to carrying burdens; but are possessed of great hardiness, so as to be capable of enduring fatigue for a long time, without being hurt by it.—Some attain their full degree of strength and bodily vigour, at a very early period of life, while others continue long extremely weak, and incapable of great exertions; but after they arrive at six or eight years of age, become hardy, and capable of exerting their strength for a very long time without being hurt.—Some are naturally cool and persevering; while others are more fiery and fretful, and can never be brought to yield that steady exertion of strength that
the

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the others naturally do.—In short, the varieties in this respect, are so many and great, that it would require a very extensive experience, to be able to point them out with any degree of precision.—But were it once done, it would be of the utmost utility to the farmer; as he would then know exactly, what breed would best answer the particular purpose that he, on any occasion, might wish to accomplish.

It would, perhaps, be of still greater utility to the farmer, to have all the peculiar and distinguishing qualities of each of the different breeds of *cattle* pointed out with precision; which probably do not differ less from one another than horses do.

Many attempts have of late been made by improving farmers in different parts of Britain, to better the breed of their cattle. But as the particular breeds of cattle that have on these occasions been transported from one part of the country to another, have been usually selected on account of qualities that they were only *supposed* to possess, rather than in consequence of any full

full investigation of the subject, by which their real good or bad qualities have been pointed out with accuracy; it may be much doubted, if these attempts have been, in many cases, attended with any beneficial consequences at all. For, so long as we are guided in this case, by any other rule than that certainty which results from accurate experiments, it may be naturally supposed, that the mind of the sanguine improver will be apt to magnify every excellent quality, that he may think he perceives in his favourite breed; while it as naturally diminishes the good qualities of such as may be out of favour at the time.

Thus, at one time, the large Dutch breed of cows were much in vogue, and were much more valued than any other kind:—But, in a few years, it was discovered that they did not possess all the qualities for which they were at first cried up; and they gradually fell into disesteem.—These were succeeded by the Yorkshire, which in their turn were succeeded by the Lancashire breed; which is at present more esteemed than any other sort,

and will probably continue to be so for a few years; when they, in their turn, will be neglected, and give place to some other favourite breed, which accident may recommend to public favour.

In this manner, it may be expected that things will go on, till mankind shall become so sober-minded, as to be firmly persuaded, that, perhaps, no one breed of cattle is possessed of all the different qualities which could be desired on different occasions, and therefore set themselves seriously to distinguish from one another the different qualities that may render this animal, on any particular occasion, more or less valuable, and then endeavour to discover which particular breed possesses that one quality in the highest degree.—Thus, one man, perhaps, requires, above all other qualities, that his cattle be possessed of great bodily strength, and a power of exerting the nerves and muscles for a great length of time, without being fatigued.—Another, perhaps, disregards this quality, and only wishes for an ox that will admit of being fattened quickly, and carry a great weight of beef.—A third, perhaps,

perhaps, requires that weight should be chiefly in some particular part of the body.—A fourth, values only the quantity of the milk.—A fifth, is chiefly anxious about its quality ;—while a sixth is, perhaps, more anxious to obtain the beef of a peculiarly fine quality than any of these, or values his cattle for some other peculiarity, different from any of those above enumerated.

But, were we to know with certainty which particular breed possessed, in the highest degree, that peculiar quality we most wished for, and the other peculiarities that it possessed along with this, we should be enabled to pick out, with precision, that particular breed which best suited our particular purpose, or the circumstances we were in at the time ; leaving others to make choice of some other breed, that might be still more profitable to them.

Hitherto, we have been so little accustomed to consider the subject in this point of view, that it would be in vain to look for facts which could be relied upon, with regard to it, from the writings or conver-

sation of such improvers as have endeavoured to introduce any particular breed into any district : For, these kinds of cattle are so much praised for every excellence when they are in vogue, and so indiscriminately decried after that period, that it is next to impossible to distinguish the qualities for which they are truly estimable, from those for which they are by no means remarkable.—It seems, however, to be pretty certain, that the large Dutch breed of cows, do usually yield a very large quantity of milk, although it is but of an inferior quality ; while, on the contrary, the small delicate Alderney breed of cows are as remarkable for the richness of the milk, and the delicacy of the butter it affords.—And although the Lancashire breed is just now in favour, and thought in general to possess almost every quality in the highest degree ; yet the ingenious Mr. Young has ventured to assert, that cows of this breed do not yield near so much milk, in proportion to their size, as the Suffolk cows ; and the Devonshire breed, is by many deemed preferable to them for draught.

As to other qualities, there is so much room for the imagination to magnify or diminish them, as prejudice may suggest, that we can hope for nothing decisive with regard to them, without fair and accurate comparative trials, made under the direction of some man of probity and discernment.

But if it would be of some use to the farmer, to know with accuracy the distinguishing characteristics of each particular breed of cattle, it would be of still greater consequence for him to know with certainty, all the varieties that take place with regard to sheep, which, perhaps, admit of a much greater diversity; and, on account of the value of the fleece, it is probable that it would be of much greater national consequence to have these accurately pointed out.—As no attempt hath as yet been made to ascertain, with any degree of precision, the distinguishing qualities of each of the different varieties of this species of animals, it is in vain to hope for any-thing like certainty on this head for some time to come.—The following hints, however, intended to serve

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as a slight beginning for such an investigation, it is hoped, will be received with indulgence by the public, on account of the great importance of the subject.

Many of the peculiarities by which different breeds of sheep are distinguished from one another, are obvious to the senses, and therefore afford an easy criterion for distinguishing them; although it is also probable, that they may on some occasions differ in some less obvious, although not less essential respects.—The following are a few of the most remarkable peculiarities in respect of which different breeds of sheep vary from one another *:

1st,

* At the time this Essay was first written, the author entertained no doubt but that the sheep was universally a *wool-bearing* animal; wool he considered as a distinctive peculiarity of the whole genus; and the remarks in the text were all written under the impression of this idea. He has reason, however, now to be fully satisfied that in this respect he laboured under a mistake, having had the most decisive proofs that there are many breeds of sheep which never produce one pile of wool, but short stiff hair only, exactly such as is produced on horses. Other kinds of sheep carry fleeces extremely different from these, and from each other, as well as from what we commonly express by the word *wool*. But as these

1st, A very great variation is perceptible in different breeds of sheep with regard to *shape*.—The Dorsetshire sheep are tall and light of body, much resembling the camel, in shape and proportions: and the breed that is most esteemed and recommended by Mr. Bakewell, of Leicestershire, are large-bodied and short-legged, more resembling the figure of the beaver.—The other varieties of shape and proportions are almost infinite. And the same may be said of all the peculiarities under mentioned.

2^d, Some breeds of sheep have horns, and others have none at all.—In Lincolnshire, a horned sheep is a rarity;—and, on the contrary, in Dorsetshire, and some parts of Wales, a smooth-headed sheep would be looked upon as a sort of wonder.—In some other places, four, six, or even eight horns, are not uncommon.—The horns of sheep are usually twisted; but some breeds have long horns, bending a

these varieties are little known in Europe, what is said in the text cannot be affected by these facts. *Note to the fourth Edition.*

little backward, but not twisted, like those of the goat.

3^d, Different breeds may be sometimes distinguished from one another by the colour of their faces. In Lincolnshire, all the sheep have white faces; and in Norfolk, they are as universally black.

4th, Different breeds vary in respect of the length or shortness of the wool.—The fine combing wool of Lincolnshire, Romney-marsh, &c. sometimes measures half a yard in length*;—the wool of Spain exceeds not two inches; and that of Dorsetshire, Cotswold, and Leominster, is little longer.

5th, They likewise vary from one another with regard to the manner in which the wool grows upon the sheep.—Sometimes the whole body is uniformly covered with a coat of wool, the hairs of which are slightly interwoven with one another

* I have some wool in my possession that measures twenty-one inches in length. It was sent to me by Sir Joseph Banks, Bart. It was taken from the fleece of a Lincolnshire ram, which when new shorn, weighed twenty-five pounds. *Note to the fourth edition.*

as if they had been frizzled by art ;—as in the Dorsetshire, and in some measure the Lincolnshire sheep.—Sometimes it divides into separate locks, which on some occasions hang down long and lank, in some measure like combed hair ; as is the case with a breed of sheep common in the South of Scotland. And sometimes these meshes are done up into separate small close curls, like a wig of baked hair ; as is peculiarly remarked in a breed of sheep in Sologne (a district in France) insomuch that it has there become a common proverb, that the wool of Sologne has been curled by the bill of the larks*, the meshes are so small, and the curls so exceedingly close.

6th, They also differ from one another in respect of the fineness of the pile of the wool.—The wool of Persia, Segovia, Leominster, and several other parts of Britain, are well known to be as remarkable for their uncommon degree of fineness, as that of Cornwall—and of Norway, is for the exceeding coarseness thereof ; these

* *La vrai laine de Sologne est celle qui a été frisée par les alouettes.*

being

being said to approach nearer to the nature of hair than wool *.

7th,

* It has been already remarked, that the climate has some effect upon the quality of the wool of sheep, the finest wool being most naturally produced in the coldest regions; from whence some may be disposed too hastily to conclude, that the several variations we meet with in this respect, ought to be attributed to that cause alone. But, that distinct breeds of sheep, differ very much from one another in this respect, independent of the influence of climate, is sufficiently obvious from this circumstance, that we find, in different districts of the same country, which enjoy an equal temperature of climate, wool of very unequal degrees of fineness; and frequently we meet with sheep, in cold countries, that carry wool of a much coarser quality than what is found in regions considerably warmer than they are. Hence, therefore, we ought to conclude, that although warmth of climate invariably tends to make the wool that grows upon any sheep, coarser than it would have been upon the same sheep, if it had been in a colder climate, yet that this has no influence on altering the nature of its progeny, nor even of producing any change upon the animal itself, longer than it is immediately under the influence of that heat. A British sheep that has been carried to the West-Indies, is generally supposed either to lose its wool, which I hold to be a doubtful fact; or to acquire a fleece that is coarser in quality than it originally had (a fact more probable, though still it is not proved)—when it returns to Europe again, affords a fleece of as fine a wool, as before it went out to that warm

7th, They likewise differ from one another in colour.—In Europe, white sheep
are

warm region: It is, however, certain, that in temperate climates, the points of the wool,—that is to say, that part of of the fleece which springs out from the the sheep's body during the warm weather in summer,—is always much coarser than that part which grows during the cold weather in winter; the difference between the top or bottom of the fleece being always in proportion to the difference between the heat and cold that the sheep has experienced at these different seasons, and consequently is smaller where sheep perambulate, as in Persia and Spain, than in countries where they never change place at all: and, in this last case, it is always greater in northern continental countries, than in islands, as has been already remarked.—

A variation with regard to the climate, therefore, produces only a temporary change upon the fineness of the wool of that individual sheep, which is immediately exposed to its influence; but the difference in this respect, that arises from a variation of the breed of sheep, is of a more permanent and invariable nature; as any two sheep, originally of different breeds, not only retain the same difference between one another, if they are at the same time carried through any diversity of climates, but their descendants also retain, at all times, if in equal circumstances, the same difference that was observed to take place at first. Hence, therefore, it may happen, that a particular breed of sheep, may carry, at all times, coarser wool in a cold climate, than another breed which always lives in a warmer region; the influence of the climate
not

are most common; and, next to these, black are most frequently seen. — In Persia,

not being so great as to counteract the superior influence that is derived from the parent stock. In fact, I now find, that there is a native breed of sheep in the Island of Jamaica, which carries finer wool than perhaps any that can be found in Europe.

It is of much consequence that the reader should accurately distinguish between these two different circumstances that influence the quality of the wool of sheep; because, if this is not done, he will be embarrassed and perplexed by seeming contradictions, that it will be impossible for him to explain; so that he will be apt to remain irresolute and undetermined in his conduct. For, if, without this knowledge, he should have attempted to improve his wool by bringing some fine sheep from a colder region to his own, and should afterwards find, that, instead of very fine wool, which they yielded in their native country, they produced to him no finer wool than his own sheep formerly afforded him, he would be apt to imagine, that the nature of his climate over-ruled every other circumstance so much, as to bring the fleece of every different kind of sheep into one quality, which he would look upon as the standard of his climate or situation, and therefore might think that it would be in vain for him to attempt improving it.—And if at the same time he should have chanced to bring from a warmer climate another breed, that in their native country yielded wool of a coarser quality than his own, and should afterwards find that the wool produced from these sheep, was of the same fineness with that of his own sheep, he would be

Persia, they have wool of three colours ; white, reddish, and silver-grey.—In the province

be still farther confirmed in his opinion of the overruling influence of his climate, and rest satisfied, that as he could not hope to improve the quality of his wool, so he need not fear that it could ever be debased ; and that of course, he needs give himself no sort of trouble upon that head.

But if the foregoing case were just reversed :—Had the farmer first chanced to take a fancy for some fine-woolled sheep that were natives of a warmer region, and transported some of them to his own country, where he found the wool become much finer than it formerly was ; and should afterwards, in his travels, meet with another breed in a colder country, that produced still finer wool than the other afforded, and, hoping that a similar change would result from a change of place in this case as in the former, should get some of these also transported to his own country :—How great would his amazement be, when he afterwards found, that these sheep, instead of being improved by that change as formerly, had degenerated so far as to produce wool of a coarser quality than either of the former !—Without having known or attended to the foregoing distinction, this phenomenon would have appeared inexplicable. But it would not have been attended with such fatal consequences as the listless indolence occasioned by the seeming natural conclusion that was drawn from the former experiment.

Before I conclude this note, it may be proper to remark, that although, the change produced upon the quality of the wool by a great variation of climate is

very

province of Andalusia, in Spain, there is a race of sheep, that are brindled, and spotted black and white ; and, in the Isle of Man, there is said to be another breed that carries wool of a light buff-colour. To these may be added, wool of a bright golden-colour, a specimen of which, I have lately (March, 1797) received from India, of a fine silky-gloss, and delicate texture ; but we know not yet, exactly, where the animal which produced this fleece was bred, or of what kind it is, with absolute precision.

8th, They likewise differ from one another with respect to the purity of their wool.*—Some breeds have their fleece per-

very considerable, yet a *small* variation in that respect produces no sensible change ; so that the farmer may in general disregard this circumstance in the changes that he may think it proper to make, by transporting the sheep of one district of the same country into another district—the variation of the breed, in this case, being almost the only circumstance worth attending to.

I now farther add (fourth edition) that I have reason to suspect, that there are some breeds of sheep, which carry wool that is not affected by a variation of climate in the same manner with that of the breed of sheep which is commonly reared in Scotland, as described in the foregoing part of this note.

fectly

fectly free of any mixture whatever, while others have a greater or smaller proportion of a particular kind of hair intermixed therewith, that is known in some parts of England, by the name of *Stichel* hair; and in the Northern counties, by that of *Kemps*; and in France, by the appellation of *Jarre*.—This is a kind of short opaque white-like hair, which grows up among the fleeces of some kinds of sheep, that may be easily distinguished from wool by its dead-like colour, and by being always thicker at the roots than towards the points (which is the reverse with wool) and by having no degree of elasticity.—As no wool that has any mixture of this can be properly dyed, or wrought into any valuable manufacture, it ought to be guarded against with the most scrupulous attention. I now also know (anno 1797) that there are sheep which afford a kind of hair, among their wool, totally different from that above described, being invariably finer at the points than the roots, and longer than the wool. Other varieties there are besides this also.

9th, Different races of sheep likewise

vary very much from one another in respect of size. In Shetland, there is a breed of sheep, so small, that when full grown and fat, will not weigh above three or four pounds per quarter ;—and another, nearly as small as this, is kept as a curiosity, in some parts of Normandy, in France : whereas, in Flanders, and some parts of England, it is not uncommon, for a quarter of mutton to weigh forty or fifty pounds*.

10th,

* We have seen, that although different breeds of sheep vary from one another very much, with regard to the fineness of their wool, and that this difference between them, so long as they remain in equal circumstances, is permanent and invariable, yet that a variation of the heat of the climate does produce a sensible effect upon the quality of the wool of some kinds of sheep ; and, in like manner, although there can be no doubt but that there are different breeds of sheep and other animals, differing essentially from one another with regard to size, yet it is equally certain, that some variation may be produced in this respect by the nature, abundance, or deficiency of their food. Thus, supposing that all the different breeds of sheep were fed upon pasture where they had, at all times, as much good food as they were able to destroy, and were treated properly in other respects, there seems to be little doubt, but that some of these would be of a much larger size than others ; whose
descendants

10th, They also differ from one another by the length of their tails.—In Scotland, the

descendants, in these circumstances, would continue to retain the same difference for ever, if they were suffered to copulate with one another: Yet, if any of these are carried to another place, where they find a more scanty subsistence, their progeny will gradually diminish in size, so as never to reach the stature of their original progenitors, so long as they remain in that half-starved condition: But if, at some distant period, some individuals of this unnaturally small breed of animals should chance to be carried to another district, where they should have more abundant food and warmth when young, their progeny would gradually out-grow their parents, till at length they should attain the full size of the original parents of their race; after which they would remain stationary, so long as they should enjoy this abundance of food and other requisites. It is from this cause that animals in Alpine countries, in which their young are usually stunted in their growth, for want of abundant nourishment and genial warmth, are almost always smaller than in low and fertile countries, where they more usually attain their natural size. Those, therefore, who allege that it is in vain to hope to alter the size of the animals bred in any country, because the pastures, &c. in each place will either raise or diminish these, till the animals attain the size that it is naturally fitted to produce, have some reason for what they allege, although it is not strictly true. Want of abundant food, or an unnatural degree of cold, will always retard the growth of a young animal, and make it stop, before it

the tail of the common breed of sheep does not reach lower than the knees; the tails of English sheep, usually reach the heels, in their natural state.—I take no notice here of the broad-tailed Asiatic and African sheep, as they are not natives of this part of the world.

The variations that take place with regard to the above-mentioned particulars, are so easily distinguishable, that the most inattentive observer cannot fail to have remarked them on many occasions. Those that follow, are not perhaps, less certain and permanent, although they do not so sensibly attract the attention :

11th, Certain parts of the fleece of every sheep are finer than other parts of the same fleece; but the difference in this respect, in different races of sheep, is very

hath attained its natural size; so that a large breed may thus become, in certain circumstances, no bigger than one that was naturally of a much smaller size. But no treatment could ever bring a breed naturally small, to equal the size of one that was originally large, if it is reared where it can have food and warmth in abundance. The different breeds of dogs afford a satisfactory illustration of this position. A mastiff and a lap-dog, though equally well fed, still retain their distinctive size.

great.

great.—Sometimes the wool about the neck and shoulders will be remarkably fine and silky, and that on the buttocks of the same sheep be exceedingly hard and coarse; and, on the other hand, some kinds of sheep afford a fleece in which the difference in this respect is far less considerable.

12th, In the same manner, as we observe that some individuals of the human species have the hair of their heads much thicker and closer than others, so it may be observed with regard to different breeds of sheep, that some of them yield a much thicker and more weighty fleece, in proportion to the bulk of the animal, than others do. It would, therefore, be of great use to the farmer, to be able to know, with accuracy, the exact difference in this respect, between any two varieties of this species of animal, that he might have it in his power to rear.

13th, Some kinds of sheep give a much greater quantity of milk in proportion to their size, than others do, and therefore make much better and fatter lambs than these, upon pastures equally good.—This

is a distinction seldom attended to, although it might be, on many occasions, of the utmost consequence to the farmer.

14th, It is well known, that certain breeds of sheep are more disposed to produce twins than others.—There is in Holland, a large breed of sheep, that seldom have less than two, often three, and sometimes four lambs at a time.—In Lincolnshire, and some other parts of England, the ewes almost universally produce two lambs; and in other parts, where the sheep are equally well fed, this is a sort of rarity.

15th, It is likewise in general believed, that some particular kinds of sheep are more easily disposed to carry lambs twice a year, or bring them at different times of the year, than others are.—The Dorsetshire sheep have been said to possess that quality in a peculiar degree;—and although this could seldom be of much utility, yet, as it might on some occasions be of use, it would be an advantage to the farmer to know all these*.

16th,

* It is commonly said, that, in Egypt, sheep year twice a year. Possibly, in that warm climate, this may
not

16th, It is also in general believed, and with good reason, that some particular breeds of sheep are naturally more hardy, and less subject to diseases or accidents of any sort than others; although the farmer has not yet the satisfaction of knowing experimentally if this be really the case or not.—Or, if it is,—What are the particular breeds that are eminently distinguishable for this valuable property?

17th, It does not seem in the least con-
not be such an exaggeration as the same hyperbolical expression is, when applied to more northern climates; although some modern travellers have denied that this is the case, even in Egypt. An ewe goes with lamb five months; so that, supposing she either did not suckle her lamb, or that she again took the ram while giving suck, within one month after yeaning (which is a thing that I believe rarely if ever happens with regard to this species of animals) it would be barely possible that they should regularly produce lambs twice a year. But as this is a thing that cannot be expected to turn out to any valuable account, in a climate like that of Britain, we may look upon it rather as a matter of curiosity than otherwise. As to their bringing a lamb, perhaps, very early in one season, and another so late, as that both are brought forth within the course of one year, I consider it as an abuse of language, to call that having lambs twice a year, and, therefore, as deserving no farther notice,

trary to reason, to believe, that there may be some particular breeds of sheep, and other domestic animals, that may, perhaps, by nature require less food to sustain them, than others of their own species, of an equal size with themselves, may require. Yet I know of no experiment, that has been made with a view to determine this important question, from which we could draw any useful conclusion.— But as it is of much importance to have this fact ascertained with precision, it surely merits the special attention of those who may have it their power to prosecute experiments of this sort.—The reasons that induce me to think that this might probably be the case, are as follow;—

We have already seen, p. 116, that some animals of one genus require a greater quantity of food, than those of another, although of an equal size: From which we may be led at least to enquire, if this may not, on some occasions, happen to be the case with regard to different varieties of the same species?—Some horses will thrive upon harder fare than others; and some kinds of cows are more easily kept

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kept up in winter than others; which would seem, in some measure, to corroborate this conjecture.

And that something of this kind does actually take place with regard to the different varieties of dogs, seems to be in general allowed;—as I never heard it disputed by those who had attended to this circumstance, as to this class of animals, that that particular breed of dogs, called Pointers, require a much larger proportion of food to keep them properly than grey-hounds do; and that mastiffs take still less food, in proportion to their size, than grey-hounds *.—I would be far, however, from asserting these as undoubted facts;—but popular opinions have for the most part some foundation in truth, and therefore, deserve to be confuted by experience, or indisputable arguments, before they are fairly rejected.

If this difficulty were solved, it would

* This observation seems to be confirmed by the experiments of Mr. Arthur Young, who finds that some kinds of cattle require one-third of their weight *per* day to feed them, and others only one-fifth. Exp. Agr. Vol. II. Art. *Cattle*.

enable us to devise proper experiments for determining another, that has been often proposed, and debated with much warmth, although it can admit of no final solution, till this previous doubt be discussed, *viz.* Whether it is most profitable for the farmer to rear animals of a large breed, or such as are smaller? that is to say, Whether a large breed of sheep or cattle require food of a better quality, or in greater quantity, in proportion to their size, than such as are smaller?—Or, in other words, Whether the same field of grass would rear a greater weight of beef or mutton, if it were depastured with a breed of large, or another of small cattle or sheep?

A large animal is so beautiful to look at, and conveys such an idea of plenty and luxuriance to the imagination, that it is apt to catch the fancy, and impose upon the judgment so much as not to allow us to attend to all the circumstances which might produce some effect, with that cautious circumspection, which is necessary in economical disquisitions of this sort. Hence it has usually happened, that those improving farmers, who have endeavour-
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ed to better the breed of these two useful kinds of animals in any one district, have attempted to do it by introducing a larger instead of a smaller kind; which circumstance alone they have always considered as a capital improvement.—But it has as generally happened, that the greater part of the inhabitants in every country, imagining that large animals of any sort, require a greater quantity of food in proportion to their bulk than smaller ones, as well as a more careful management, have always looked upon these attempts to introduce a larger breed among them rather as hurtful than beneficial, and have therefore opposed such innovations with all their might.—Now, if it should be found, upon a proper examination, that some varieties, either of the ox or sheep, require a greater or smaller proportion of food than some other varieties of these do, it would be possible, that each of these two opposite opinions might, in different circumstances, be just. For, it might so happen, that of two varieties that should be compared with one another in one corner, the smallest might be the most hardy

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hardy breed, and that which required least food in proportion to its size,—while, in another district, where the same experiment should chance to be tried, the largest of the two might possess these valuable qualities in a more eminent degree : So that till the first difficulty is finally determined, we can draw no general conclusion from any particular experiments that might be made with a view to elucidate the second.

The above catalogue comprehends almost all the particulars that occur to me, as contributing to occasion any variation between the different races or breeds of sheep.—And if it be considered, that not only each of the opposite qualities above enumerated may be possessed by different breeds in all the intermediate stages between the one extreme and the other, but also that any one or more of the other peculiarities may be blended with these in all possible proportions, we will easily perceive that the varieties produced by this means may be almost infinite ;—so that it is perhaps impossible to form any adequate idea of the improvements that might be made

made in this particular branch of rural economics, should the general attention be properly directed towards it, and the judicious efforts of individuals be long enough continued.—But as many opinions prevail on this subject, that seem to have been derived from the limited observations of private individuals, who have not had an opportunity of being better informed, which tend very much to discourage the attempts that might be made towards improvement in this respect; it may not perhaps be improper, before we leave this head, to examine, with some degree of attention, a few of these popular opinions, with a view to discover if they are founded on reason, or the reverse.

It seems to be an opinion rather too universally prevalent, that that breed of animals which is found in any one district, is more peculiarly adapted to the nature of the climate, and other circumstances relating thereto, than any other that could be introduced into it; and that, of consequence, any attempts that may be made towards any improvement in this respect, will not be attended with the expected success.—But although it should
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be allowed, that the beneficent Creator of this Universe, hath, in general, provided every country with those productions, whether of the animal or vegetable kingdom, that are most essentially necessary to the existence of the inhabitants thereof; yet, as daily experience proves, beyond a possibility of doubt, that peculiar animals, as well as vegetables, are sometimes found in one country, and not in another, which is exactly similar to it in every respect; and that these animals or vegetables do thrive when transplanted to it, as well as in their native country; it would seem that this partial deficiency had been wisely so ordained, to serve as a spur to human ingenuity and industry,—as a most powerful means of promoting that social intercourse between different nations, which hath such a direct tendency to correct local prejudices, and humanize the soul, rather than to repress those vigorous exertions of the mental powers in which the principal happiness of man so evidently consists.—And the success that has attended many attempts of this kind, and the benefits that result from

from thence to society in general, sufficiently confirm the observation. — The silk-worm was long confined to a particular district of Asia alone, although it has been reared for hundreds of years past, to as great perfection in many parts of Europe as in its original native country; and the breed of horses in Britain, which are now supposed to exceed in swiftness those of all other nations, are all known to be descended from parents that have been imported from distant regions. — Pears, cherries, peaches, apricots, and all the other fine fruits of our gardens, are natives of other distant countries, and were utterly unknown, not only to our ancestors in Britain, but to every European nation: — Even cabbages, coleworts, and colliflowers, with almost all the numerous train of garden-roots and pot-herbs, were only of late introduced into Britain, where they are now reared in greater perfection than on any other part of the globe. — Horses, cows, and sheep, were not known in America before the Europeans settled there; — peaches, which now grow wild in every corner of America, and flourish
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with a luxuriance unknown in every other country, were only introduced into these regions by the first settlers from hence :— And it is but of yesterday that the first handful of rice was accidentally brought into Carolina ; where it has since prospered so exceedingly, as to enable the inhabitants of that country to supply almost all the markets of Europe and the West Indies, with that useful grain.—In short, the benefits that society hath reaped from judiciously transporting the animals or vegetables of one country into another, that might stand in need of them, are so many and great as might fill whole volumes barely to enumerate ; and ought to serve as a strong incitement to us, to attempt such farther improvements in this respect, as well-informed reason may point out as useful.

It likewise happens to be too universally believed, that the peculiar qualities of any breed of domestic animals, that may have continued long in any one district, are chiefly to be attributed to the nature of the pasture, or some other peculiarities of the soil or climate of that district, and not
to

to any difference in the primitive qualities of the original breed of animals.—Thus, an inhabitant of Lincolnshire fondly imagines, that the length of the wool that his sheep produces, is owing to the peculiar temperature of the air, which that county enjoys, or the nature of the pasture that there abounds.—A native of Cornwall as sincerely believes, that the very coarse fleeces which his flocks afford, are to be attributed to similar causes. In this opinion, each of them is strongly confirmed, by observing, that if any sheep that carry wool of a different quality from that of their own, are introduced into either of these counties from any other district, their progeny in a short time lose all those original marks of distinction, and can no longer be perceived to differ in any respect from their own original breed. From this observation, they, with seeming good reason, conclude, that it is in vain for them, in the one case, to hope to improve the breed of the county; and that it is equally foolish, in the other case, to give themselves any uneasiness lest their's should degenerate; seeing the pastures or climate
of

of each county will quickly bring any strange breed of sheep to a perfect equality with their own. And thus each party sits down contented with his own flock, thinking it is out of his power to make it better or worse than it happens to be at the beginning.

I do not, however, know a more fallacious experiment than this, nor one that is attended with more pernicious consequences to the public; and, therefore, it deserves to be examined with the most scrupulous attention.

The fact is undoubtedly true; but the inference that has been drawn from it, is probably extremely erroneous; as there seems to be the strongest reason to believe, that the change produced upon the progeny of these strange sheep is to be entirely attributed to the mixture of the blood of these, with the native sheep of the country; and, perhaps, not at all to the influence either of the soil or climate.—For, as it is next to impossible, to keep a few sheep distinct by themselves in any country during the rutting-season, it is not to be doubted, but that the lambs produc-
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ed by this promiscuous copulation, will participate of the nature both of the father and mother. And as this mongrel breed likewise intercopulate in their turn with the native sheep of the country around them, their descendants more nearly approximate to the nature of these; and their progeny coming still nearer and more near, to the native sheep of the country, in a geometrical progression, it must necessarily happen, that in a short time, the qualities which distinguished these strange sheep at first, being so much divided among their descendants, become altogether imperceptible to the senses.—In the same manner, a drop of milk mixed with an equal portion of water, becomes sensibly diluted; and if that compound is mixed with a larger quantity of water, it becomes still more and more colourless; and if the same operation be repeated several times, the single drop of milk, dispersed through a whole bucket of water, seems to be totally annihilated, and does not sensibly diminish the transparency of that limpid fluid; although there is no doubt, but that the milk is still there present, and

is no farther altered than by being divided into such minute parts as to elude our senses.

That the change produced upon the descendants of these strange sheep, is to be attributed to the cause above mentioned, and not to the influence of the pasture or climate, seems highly probable from this circumstance, that we frequently meet with distinct breeds of sheep in two neighbouring districts, that vary very little from one another, either with respect to climate or pastures; as is the case with the neighbouring counties of Lincoln and Norfolk, —each of which hath possessed, for hundreds of years past, their own particular breed of sheep, that are very easily distinguishable from one another; the sheep in this case, being more effectually kept from intermingling with one another, than can usually happen in two neighbouring counties, by the fens and the wash that separate them.

But what proves, beyond a possibility of doubt, that these changes are not to be attributed either to the soil or climate, but merely to the intermixture of blood, is, that

that the original sheep which come from one district into another, may remain there as long as you incline, without undergoing any change;—the alteration being only observed to take place with regard to their descendants.

It is probable that any one of the distinguishing properties above enumerated, may be united with any other of these, in the same animal, in any proportion: Nor does it appear, that we are as yet possessed of any facts that should induce us to believe, that any two of these qualities are more usually connected with one another, than with any other two or more of them; although popular prejudice has on some occasions supposed, that some of these peculiarities are more naturally connected with one another, than they are with some of the other qualities.—Thus, many persons are disposed to connect, in their own minds, the idea of fineness of quality of the wool, with smallness of size in the animal, although it does not appear that we are possessed of facts sufficient to confirm this conjecture.—The sheep of Lincolnshire and Romney-marsh are among

the largest in England, and carry much finer wool than those of Derbyshire and Northumberland, which are of a much smaller size.—Neither are we to conclude, that largeness of size necessarily produces fine wool. For the Tees-water sheep are as large as any of these, and afford a wool of a very coarse quality.

Others are disposed to imagine, that the length of the wool is in some measure connected with the size of the sheep; thinking that small sheep have always shorter wool, than those that are larger.—But neither is this confirmed by experience.—The Dorsetshire sheep, which yield short carding wool, have a much larger body than a small breed of black-faced sheep, in the South of Scotland, that carry wool almost as long as any in England;—and the sheep that produce the finest short Segovian wool, in Spain, I am assured from good authority, are nearly of as large a size, as the best breed of sheep in Lincolnshire.—The last-named sheep afford a proof, that the largeness of size does not obstruct the length of the wool; although the Tees-water sheep, which are much larger,

larger, do not produce wool of near such length of staple as these do.

Others again are more disposed to think, that fineness of staple, is in a great measure connected with the shortness thereof:—But neither do we here meet with the facts necessary to confirm their hypothesis.

—Lincolnshire wool is much longer than that of Durham, Derbyshire, or Cornwall, and it is at the same time of a much finer staple.—The longest wool upon the same fleece, is indeed, usually the coarsest part of it; from whence, in all probability, this opinion has been derived.

Others think, that fineness of wool is connected with delicacy of constitution in the animal.—But this we have no reason to imagine from experience: For, we do not find that the fine-woolled sheep of Shropshire, Somerset, Hampshire, Kent, or Surrey, are more tenderly treated, or subject to more accidents, than the other coarser-woolled sheep in the kingdom. And if I might venture to speak from my own private experience, I could safely affirm, that after having kept in the same

flock for some years, several distinct breeds of sheep, some of which yielded much coarser wool than others, it has so happened that the finest-woolled sheep have been at all seasons in the best order.— From which, however, I would by no means infer, that this is always the case; as I make no doubt but these two qualities, fineness of wool, and delicacy of constitution, may be sometimes united in the same breed, as well as any other two qualities.

Others think, those sheep that carry fine wool, have necessarily a thinner fleece, and consequently less wool in proportion to their size, than such as yield coarser wool. But neither have I met with any facts that would induce me to believe that this is always the case. The sheep in my own flock which have the finest wool, yield likewise the most weighty fleeces in proportion to their size, in the *ratio* at least of three to two; and it is now well known that the fleece of the fine-woolled Spanish sheep is much closer in the pile than that of any breed of sheep reared in Britain.

I might go on, and enumerate several
other

other qualities that have, with as little reason as the above, been supposed to be necessarily connected with one another; but, to avoid prolixity, I decline going any farther in this investigation at present;—hoping I shall not be accused of precipitancy, if, from the above examples, I should infer, that we have much reason to think, that sometimes one or more of these distinguishing qualities may be found united with some other of these in one particular breed of sheep, while these same qualities may be united with some other distinguishing peculiarities in some other breed: and as this may be varied almost to infinity, it ought to put us much upon our guard against drawing general conclusions from any particular experiments.

It would seem likewise that we might naturally infer from the above induction, that seeing there may be such an infinite diversity in this respect, no one needs ever to despair of being able to improve his own particular breed, so long as it is not possessed of all the valuable qualities that he would wish for; as it is possible he

may meet with another breed that possesses these qualities he wants, or may get them communicated to his own, by properly crossing with others: And that, therefore, instead of sitting down in listless indolence, trusting entirely to Providence for the meliorating his flock, he may have his eyes always open, to mark every advantage that fortune may throw in his way, and his reasoning faculty alive and active, so as to distinguish with accuracy how far any proposed alteration may be attended with any essential improvement, or the reverse.—If the Cornish farmer, and others who, like himself, are possessed of a breed of sheep yielding very coarse wool, or such as is mixed with *flitchel hair* (kemps) instead of sitting down contented with these as the best that his situation would admit of*, had, with a discerning attention, studied to better his breed, he might have reaped from thence, long ere now, some very essential benefits.

* I have been informed, and have good reason to believe, that the Cornish hair, as it is usually called, has been somewhat improved of late, by an attention to improve their breed of sheep.

But

But if, from the above induction, we have room to hope for high degrees of improvement, we likewise from thence see great reason to induce us to proceed in our attempts of this sort with the most cautious circumspection: Because, if we do not attend to all the collateral qualities, if I may so express myself, that any particular breed of sheep may possess, united with that particular one we wish to obtain, it may so happen, that for the sake of that estimable quality, we may sacrifice several others, of much greater value *.—But if we have all these important objects in view, and bestow upon each its proper degree of attention, it is impossible but our attempts must be attended

* Those spirited farmers who wish to improve the quality of their wool, by introducing fine sheep from other countries, ought to be on their guard, lest they thus introduce diseases into their flocks that are not easily eradicated.—Of late, an alarming disease has made its appearance among the sheep in Lincolnshire,—improperly called the *ricketts*.—It is not infectious by contact—but runs in the blood, and seems to be always hereditary.—It never fails to be fatal to all the sheep that are affected by it, as no sort of cure has yet been discovered for it.

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with success *. And as nothing could so much tend to facilitate any attempt for an improvement of this sort, as an exact enumeration of all the particular breeds of sheep that can be found in this or any other country, with a special description of all the distinguishing peculiarities of each, it is very much to be wished that such a thing could be accomplished.

Goats are, in general, much less esteemed than sheep: Yet, as these may be properly kept in some situations where no other animal could live so well, it might be also of use to have a special enumeration of the various breeds of this species of animals, with a particular enumeration of the peculiar qualities of each.—On the mountain called *Sierra de Strella*, near Almeida, in the province of Beira, in Por-

* The very great improvements that have been made upon the breed of horses in Britain, in the course of some centuries past, ought to encourage us to hope, that with an equal degree of attention, we might be able to make a still higher improvement on the nature of our sheep, as the climate is more favourable to this animal than the horse.

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rugal, I have been assured, that there is a breed of large fine goats remarkable for yielding a very great quantity of milk;—a gallon, or a gallon and a half English (two or three pints Scots) per day.—These would probably be of great use for being taken into ships for long voyages, were they introduced into Britain.

Whether the goat of Angora, that affords the fine silky hair called Mohair, be only a variety of the common goat, as Dr. Hasslequist imagines, or a distinct species by itself, seems not as yet to have been ascertained with certainty.—But of this, and some others of the same class of animals, I shall have occasion to speak hereafter.

The peculiar properties of the different breeds of hogs are as little known as of the other domestic animals, and therefore deserve to be enquired into.—The small Chinese hog, is vastly different from the large English breed, in size and appearance.—But we have as yet no accurate experiments on which we can with certainty rely, for ascertaining the peculiar qualities,

qualities, either of these, or of the different breeds known in Europe.

XXXV.

It is in general believed, that old pastures are much more valuable than new. Is this really the case?—If it is, to what causes ought this to be ascribed?—or, are there any means of obviating this inconvenience?—What are they?



That some old pastures may be found, which afford a greater abundance of excellent food for quadrupeds than any that are new, is a fact so universally acknowledged, as hardly to admit of a dispute; but there is as little room to doubt, that the opinion which in many places so much prevails that every pasture-field that is old, is necessarily better and more profitable to the community, than if it were ploughed up, and again judiciously laid down to grass, with the system of farming that has been engrafted upon it, of absolutely

absolutely restricting the possessors of such fields in any case from ploughing them up, has been attended with very pernicious consequences. It is therefore of much importance, that the false principles upon which this opinion is founded, should be exposed, and the erroneous tenets that have been adopted in consequence thereof exploded.

It is but about a hundred years since the practice of sowing any kinds of grass-seeds was first introduced into Britain. And as before that period, every field, when allowed to remain unploughed, became in time covered with such grasses as chanced to have their seeds or roots in the field without any effort of the farmer, these were called natural grasses, in opposition to those that have been since that time propagated by sowing, which have been called artificial grasses.—And although these last are in many cases indigenous plants, and as much natives of the soil as any others, yet this inaccurate distinction still prevails, and, along with it, an opinion, that as those plants that are found to spring up spontaneously in the
 soil,

soil, are evidently better adapted to it than those that are thus, as they imagine, contrary to the intention of Nature, forced upon it; so, of consequence, it is better to allow these quietly to establish themselves, than to force them to give way to strangers.

This mode of reasoning has probably induced many to imagine, that every attempt to improve our pastures, by sowing what they call artificial grass-seeds, will be without success:—In which opinion they are farther confirmed, by remarking, that those fields which have been attempted to be laid out for pasture, and have been sowed with the seeds of these artificial grasses, have hardly in any case produced a pile so close or so fine, as what is frequently remarked in those old pastures which bountiful Nature hath clothed with her most valuable robe.

It will not, however, be alleged, that our fields, if left to themselves, will furnish such abundant crops of cutting-grass or valuable hay, as may with certainty be obtained from them by cultivating some of these artificial grasses; so that we
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have the fullest proof that Nature may in this case be improved upon. And although it is probable, that none of the grasses that have been hitherto cultivated by the farmer, are of the most proper kind for pasturage; yet, there is little reason to doubt, but that many of the most valuable kinds for this purpose, would admit of being cultivated with the same ease as some of those are with which we are well acquainted, if they were properly separated from others, and cultivated with equal care.

But so long as we shall remain ignorant of the peculiar qualities of each kind of grass, so as not to be able to distinguish the good from the bad, it is not surprising that we should remain firmly persuaded that Nature alone can provide valuable pastures, and that age is so essentially necessary for bringing them to their ultimate perfection.—For if we allow our fields to remain uncultivated, without having sowed them with any kind of grass-seeds, it must ever happen, that the seeds of such grasses as are brought by the wind or otherwise, from the neighbouring fields,

fields, will there take root, and in time establish themselves: — And as it may sometimes happen, that some of the most valuable pasture-grasses may there abound; the field, in these cases, will become filled with their seeds, and in due time may afford the most valuable pasture. But if bad kinds of grasses should abound in the neighbourhood more than the good, the field will as naturally become filled with the seeds of these useless plants.—And as a number of these are hardy and abiding plants, if the field is once filled with them, the pasture will be, of consequence, always of little value, if it should be allowed to remain undisturbed for any length of time.

Thus we see that the only difference between natural and artificial grasses, is, that, in the last case, the seeds are sown in such quantities by the husbandman, and so properly disposed for vegetating, that they come up at once in such abundance as to fill the whole field entirely, without allowing room for other grasses to spring, in any considerable proportion, among them;—whereas, in the first, the seeds
are

are only slowly and scantily brought by the winds, and exposed unprotected to all the vicissitudes of weather : so that it is long before the field becomes fully stocked with them, and must at last be filled with such hardy sorts as may chance to be in the neighbourhood, whether they be good or bad.

And as in these circumstances, the roots of short-lived plants, such as couch-grass, knot-grass, narrow-leaved sorrel, wild-mint, and others of that sort, that are usually found in loose cultivated ground, are allowed to spread without interruption ; and as they have in this case no other plants to contend with, they advance for a year or two after the field is laid into grass, with the greatest luxuriance ; so that the first two or three crops of grass on such fields, consist almost entirely of these, together with a few annual weeds that spring up in such uncultivated fields. And it is only after these plants gradually die away, that the weaker and more valuable perennial grasses begin to establish themselves, and the pasture becomes gradually better, if circumstances should have

concur to establish the seeds of valuable grasses in that field.

Thus we discover the reason why natural pastures never can be so good when they are new, as they may become afterwards.—Whether the same objections lie against artificial pastures, is not so certain.

The above will be acknowledged to be a fair and genuine account of the establishment and progress of a field of natural grass, and well demands the serious attention of the reader.—Let him consider how numerous the circumstances are that must accidentally concur together before it is possible to expect a very fine field of pasture-grass, if left to Nature, and then he will perceive how improbable it is that all these should concur to produce their full effect in any one field whatever.—There must be no roots of bad grasses, nor seeds of robust annuals in the soil when it is left out from tillage; and the seeds of the most valuable kinds of grasses must be in the neighbourhood in such abundance as to fill the whole field sufficiently at once. Nor is this all.—For as there are, no doubt,

a con-

a considerable variety of valuable kinds of grass, some of which are naturally fitted to grow to perfection on one kind of soil, or upon that soil when in certain circumstances, while others would thrive best upon another soil, or upon that soil only in certain peculiar circumstances; it must so happen, that these very plants which are best adapted to the soil in the state it may be in at the time, should be found in abundance in the neighbourhood of the field. Neither must there be found near that, any sort of robust quick-growing plant, the seeds of which, by being blown upon that field, might suddenly rush up, and suffocate, in their infancy, these tender and valuable plants.—Nor must there be found any bad kinds of grass, that, by being established along with the good in any proportion, might tend to diminish the value of the pasture.—Now, let any one reflect on the infinite diversity these few particulars may admit of, and think how utterly impossible it is that all the favourable circumstances, without any of those that are unfavourable, should concur in any one case, and

he will acknowledge, that those who found their hope of obtaining the most valuable pastures only upon the fortuitous concurrence of all these circumstances, or who imagine that every pasture which is old must, on that account, of necessity be good, act in direct contradiction to the plainest dictates of reason and common sense.—For, although it should be allowed that the grasses hitherto cultivated are not of the most proper sort for forming good pastures, and that therefore, on some occasions, much better natural pastures may be met with than could be formed by means of any of these; yet it by no means follows from thence, that if the farmer were perfectly acquainted with the value and distinguishing qualities of each kind of natural grass, and knew the soil and culture that best agreed with it, the most proper manner of rearing it, and every other particular relating to the economy thereof, he might not perhaps have it in his power to form artificial pastures as much excelling the natural as these last at present usually exceed the former.—For, were he possessed of the knowledge
above

above supposed, he could at once fill his soil with the seeds of those valuable grasses which he knew were best adapted to it, and thus effectually exclude the admission of every useless plant, or pernicious kind of grass, that might be brought from the neighbouring fields by the wind, or other accidental causes *.

Thus

* I cannot, on this occasion, omit taking notice of a circumstance that produces many disagreeable consequences, and therefore deserves a more particular degree of attention, than it has hitherto obtained among modern improvers, *viz.* an inattention to the nature of the plants that grow in the margin of ploughed fields, and other waste corners of the farm. These places are often filled with docks—ragwort—thistles—and other useless or pernicious plants; which are allowed to remain undisturbed till the seeds are brought to perfection, and dispersed by the wind through every corner of the farm, where they spring up in abundance, to the infinite prejudice of every useful crop, and the ruin of the farmer, whose attempts to clean and enrich his fields, are thus perpetually frustrated; for the richer and cleaner his ground is, it is the fitter for rearing these pernicious weeds with the greater luxuriance. Every man, therefore, who hopes to be benefited by his labours, ought to be peculiarly attentive to see that every bad plant be cut down before it comes to flower, in every part of his farm.—One thistle—or ragwood, that escapes in a neglected corner, may produce seeds enough

Thus it appears, that the very best soils,
if allowed to run into natural grafs, may,
from

to flock a whole field; and the seeds are so light, that they are dispersed to an amazing distance around; so that it is of the utmost consequence that none of them escape.

This is a sort of attention that no man ought to neglect:—But the farmer who wishes to reap the full value of his grounds, may go one step farther, and make these borders of his fields prove beneficial, instead of hurtful. With this view, he ought to dig, manure, and lay perfectly level, the borders round all his inclosures, and sow it down with proper grafs-seeds once for all. If it is made smooth, it will serve for a proper and agreeable walk;—if it is made rich, the grafs will become so luxuriant, as to admit of being cut by the scythe while the field is in corn; and if it is filled with proper kinds of grafs, it may help to stock his fields with valuable plants, instead of pernicious weeds.

To make the farmer understand the full import of this last hint, it is necessary he should be informed, that there are many valuable plants and grasses, whose seeds cannot be saved without some trouble, that might be readily disseminated through the fields, if the borders were filled with these.—Of this sort is the soft grass, (*poa pratensis*) already taken notice of, and the yarrow plant, whose seeds may, indeed, be collected by hand, but which would be more easily disseminated by the wind, if allowed to ripen in the borders—for it is as light and chaffy as the ragwort seeds. If these were allowed to ripen and shed their seeds that season that the field

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from accidental causes, become stocked with a variety of bad and unprofitable plants,

field was to be laid out for grass, it is not to be doubted, but many of the plants would spring up in the fields while under pasture.

There are many other plants, whose seeds can hardly be at all collected by the hand in sufficient quantities, that might on many occasions be planted in our fields by this means, if duly attended to.

On the subject of extirpating hurtful plants, I shall here take notice of one fact, that may on many occasions be of use, if adverted to. Few plants are more hurtful to pasture fields, than the common ragwort (*senecio jacobæa*) which, if once established in a field, can hardly ever be entirely extirpated; and when it has once spread through a large district of country, can scarcely be banished from a particular field: But nothing is more easy than to eradicate it entirely, when it first makes its appearance in any part of the country where it did not formerly abound, as I once experienced, in the following manner:

I possessed a farm in a part of the country where this plant did not abound; but some of the seeds of it had been brought by accident among the grass-seeds, with which I sowed a field on that farm. The second year after sowing, that field was pastured, and it was very much choaked up with ragweed. I took care, however, to cause every plant of it to be cut over, when it began to show its flower; and was attentive myself to observe, from time to time, that not one plant escaped: the consequence was, that next year only two or three plants ap-

plants, so as to remain for ever a coarse and disagreeable pasture: In which case, an absolute restriction from ploughing, and thus giving it at least another chance of being stocked with better plants, or producing other more profitable crops, must be considered as an essential detriment to the public.

But this may be looked upon as a favourable case, in comparison of many others that daily occur, from an injudicious attachment to this erroneous principle.—For although it is usually admitted as an indisputable axiom in agriculture, that so long as ground remains in pasturage, it is always in an improving state, the soil necessarily becoming richer and

peared, in place of as many hundreds, perhaps thousands, the year before. These few were carefully cut over, and the field ever afterwards was quite free of this destructive weed. It is obvious, however, that if it had abounded in the adjoining fields, the same effects would not have resulted from this operation, as the seeds would have been blown from thence into my field. It is a biennial plant—the seeds that are sown this season, only come into flower the next year, and if the plant be cut over when in blossom, the root dies down during the ensuing winter, before it can produce any seeds.

richer

richer every year, which is not supposed to be in general the case, with regard to ploughed grounds; and although it be from hence inferred, that those who absolutely prohibit the converting any of their grass-grounds into tillage, act a wise and patriotic part, as they thus transmit to their posterity, a subject richer and more valuable than they received: Yet, I imagine, there will be found much reason to apprehend, that the truth of the axiom may be justly disputed, and that the inference which has been drawn from it may be erroneous.

That a soil which is naturally fertile, and in good order, may be meliorated by being allowed to remain long in pasture, if it be stocked with valuable kinds of grasses, will be readily allowed: But if it is naturally unfertile, or disposed to produce several kinds of bad and unprofitable plants, instead of becoming richer by remaining long in grass, I am well satisfied, from numberless observations, that in many cases it gradually grows worse than at first, and not only affords less food for animals than at some former period, but even

even becomes less fitted for producing abundant crops of grain at any time to come, than it would have been if it had been sooner converted into corn ground.

Those who are disposed to be startled at the seeming novelty of this opinion, will please to recollect, that if ground must necessarily be improved by being allowed to remain in grass, without any regard to the state that it might be in at the time that it was first allowed to remain undisturbed by the plough, it would of necessity follow, that all wastes, commons, and other barren patches of ground that have ever since the creation been allowed to produce the plants which naturally spring up on them, must be constantly improving, and becoming gradually richer and richer every day :—a circumstance that I believe no man, in his sober senses, will take upon him seriously to affirm.

But that these, in many cases, not only do not improve, but actually grow worse and worse, if certain plants are allowed to grow upon them, seems to be pretty evident from the present state of many parts of Scotland, that were deserted
about

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about the beginning of this century, in consequence of a severe famine which then prevailed in the land, and have been allowed to remain uncultivated ever since; in consequence of which, they have become gradually covered with heath, and not only afford very little grass for pasture, but have become in a great measure unfit for bearing corn of any sort.—For wherever heath abounds, there is generated, by the rotting of the leaves and roots of this plant, a peculiar kind of black earth, that is not only of itself sterile, but has also a powerful tendency to render any soil with which it may be mixed unfertile; inasmuch, that the most effectual way to improve ground upon which this plant has grown, is to bury that earth entirely, by trenching, which, on many other occasions, would be rather hurtful than beneficial*.—Now, as it seems to be pretty certain

* The reader is desired to attend to this distinction.—If he is an inhabitant of a rich corn country, he will be convinced, from experience, that trenching corn-ground, is in general hurtful.—If he lives in a barren moorish country, he will as naturally be inclined to believe, that trenching is, almost in all cases, a capital improvement.

certain that this plant naturally tends to deteriorate the soil upon which it grows, what

provement.—Ought not this to teach farmers who have been confined to one district, to be cautious how they criticise, with contemptuous asperity, the general conduct of those of another district, possessing a soil of a different nature, or in a different state from their own?—I hardly know a more helpless creature, or one who would deserve more to be pitied, than a mere practical farmer, who should move from a rich highly improved soil, in a good climate, to possess a farm in an unimproved country, where the soil and climate were naturally bad, and manures without his reach.—If this observation be well founded, ought it not to make us entertain a doubt, if the practice lately introduced into some of the unimproved parts of Scotland, of gentlemen sending their sons to the most improved counties in England, to learn the practice of agriculture, will be attended with all the beneficial consequences that are at first expected to arise from it?—In an unimproved country, a farmer has numberless difficulties to encounter, that are not known or dreamed of in one where agriculture has been long practised with success.—And is it in the lap of ease, and in the midst of abundance, that one learns best to suffer hardships with fortitude, and overcome difficulties by perseverance? Is it within the walls of a garrison, that a general may best learn the art of war? or, is it not rather in the field, where dangers surround him on every hand, while opposed by a vigilant and active commander, that he learns the much prized art of destruction?—It is nearly
the

what proof have we that there is no other plant that may be possessed of a similar destructive

the same with a farmer in an unimproved country.—He is surrounded with so many difficulties—meets with such powerful interruptions at every step—and must proceed so slowly and cautiously in all his operations, as would totally overcome the spirit of one who had been accustomed to live in a happier situation.—If one hopes to practise farming in these circumstances with the smallest prospect of success, he must not only be possessed of a sagacious penetration, in distinguishing, with precision, the nature of the different soils he may meet with, and the crops that each of these will best carry, but a solidity of judgment, and an unbiassed impartiality of mind, that may enable him to vary his practice so as to suit the nature of that soil, and make it produce perhaps, the only crop that it is fitted to rear:—A species of knowledge that must be self-taught—as neither the experience of his ancestors—his neighbours—nor the best farmers, in another situation, can avail him any thing.—He must likewise be possessed of a coolness of temper, that is not apt to be startled at meeting with unforeseen obstructions, and an obstinate industry that persists till these are overcome, however great and numerous they may be—a versatility of genius, fitted to adapt itself at once to the circumstances that may occur, so as to seize every advantage that fortune may throw in his way—a patient forbearance, and vigilant foresight, that may perceive difficulties at a distance, so as to guard against them before they come
to

destructive quality?—And as it is found that in many parts of the country where the

to press with irresistible power—and a moderation in his desires, that can be contented with little on all occasions.

With all these qualities, a man, in many situations, may be reckoned fortunate, if, after a long life spent in the most vigorous exertions, and persevering industry, he can bring his fields into such order, as barely to admit of beginning to introduce some of those modes of culture that were fully established in the improved district, which was proposed as a model to him in his early years. Is it proper to send a young man, who has such a rugged scene to encounter, to the smooth and fertile fields of plenty?—Is it fit to inspire his youthful mind with a taste of those sweets which he is doomed never to enjoy?—Is it wise to send one to learn to overcome difficulties, to a place where none of these difficulties ever occur?—Is not such a plan apt to inspire the youthful mind with a vain and presumptuous confidence of success, that is in danger of making it engage in chimerical plans of improvement which can never be realised—which end in disappointment and chagrin—perhaps in utter ruin and misery?

I have been induced to delineate this faithful picture, from having seen it too fatally realised in more instances than one;—and from having observed that some writers of late have exerted themselves to the utmost, to endeavour to promote such chimerical projects.—It is painful to see individuals hurt, by improper

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the soil is naturally unfertile, the grass,
in a few years after the field has been al-
lowed

per ideas getting possession of their mind—but it is still more painful to see a whole nation labouring under inconveniences that are produced by this means, and not endeavour to remove them.—Thousands in Scotland are at this moment groaning in misery, in a great measure from this cause.

Those who have been accustomed to live in the regions of plenty—of industry and knowledge—who have been used to see abundant crops waving in luxuriance on their fields—who look with contempt on the unskilfulness, and laugh at what they deem the puny attempts at improvement of those who live in barren countries, will, no doubt, accuse me of prejudice, should I give it as my opinion, that, with half the genius—half the application and industry—half the knowledge—half the money, and one-tenth of the time, a farmer who lives in a rich country, already forward in culture, may bring all his fields into such order as to carry onions, or any other garden-crop, before one who, in certain circumstances, undertakes to improve barren and uncultivated ground, will be able to bring it to bear tolerable crops of any kind of corn or grass.—Yet, if I can trust to my own most attentive observation and experience, this is undoubtedly the case. See this subject farther illustrated, vol. iii. Essay Second.

Let it not, however, be imagined, I mean to insinuate that a farmer can gain no advantage by travelling into a country where there are more improvements than in
that

lowed to remain untilled, becomes gradually more scanty than it was; and that the fields are not rendered more fit for producing corn, by being allowed to remain a long time in that state after that period, it would seem that we have sufficient reason to conclude, that those only who possess a soil naturally fertile, can expect that it will be meliorated merely by being allowed to remain for a great length of time without culture; and that those who possess pastures which are naturally not very rich, or such as do not abound with the most valuable kinds of grass, are not only guilty of great want of economy with respect to themselves and families,

that were he resides.—Nothing can be farther from my intention.—I would only wish to inculcate this useful maxim, which might with justice be applied to all kinds of travelling,—That it is not the young and inexperienced who can be properly instructed by this means—but those who have already made some progress in those arts or sciences they wish to be instructed in—whose experience has taught them caution, and whose habit of attention has enabled them to select with judgment, and adopt with a wise discrimination, such particulars only as they know can be applied to their own particular purposes—and reject the others as useless or pernicious.

but

but essentially hurt the interest of the state, by either neglecting to improve these fields by tillage themselves, or by depriving others of the liberty of doing it. The reader who refers to the case of what has been called *hide-bound* soils, in the foregoing Essay on Draining, will perceive, that the evils produced by that restriction are sometimes of immense magnitude.—Nor are those less excuseable, who, possessing fields perhaps naturally of very great value, suffer them to be over-run with a most destructive vermin, that soon convert the finest pasture into a most desert waste, and yet refuse to grant liberty to plough up these fields, which is the only certain and most economical way of totally clearing a field of ants, where the situation does not admit of laying it totally under water till they be all destroyed *.

Let

* Scotland is not, in general, so much pestered with ants as England is; but, in some places there, this insect is so exceedingly pernicious, as to prove a most grievous pest to society;—nor are the palliative methods of eradicating these insects, usually practised by improving farmers, by any means efficacious.

Let us, therefore, instead of contenting ourselves on all occasions with such pastures

Much ingenuity has been displayed in inventing instruments for cutting up the surface of the hills, and smoothing the fields; and they have, in some cases, been brought to such perfection as to effectuate this very well, at a moderate expence: But after the farmer has smoothed his field, and burnt the hills, and thus, as he imagines, effectually destroyed all the vermin and their eggs, he has the mortification to find, that, in a very short time, his field becomes uneven; and before it is sufficiently stocked with grass, the same operation needs to be repeated.

This operation, for many reasons, is ordered to be performed in winter, and early in the spring; for few persons choose, if possible, to lose the whole produce of the season by doing it in summer. It is likewise imagined, that by cutting up the hills during the severe weather in winter, the intenseness of the cold freezes these tender creatures to death: on which account, winter is thought to be by far the most propitious season.

But the experienced Naturalist, who has studied the economy of this *little people*, knows, that at that season of the year, they have retired so far below the surface as to be in no danger of being disturbed by these operations; and have their houses too well secured, to be much incommoded by the removal of their hills, which at that time are of no sort of use to them.

A very few of the insects, indeed, may be scorched by burning the hills, if that is long delayed in the spring; but, as this is an active animal, and can suddenly retreat from

tures as Nature may afford, rather study to improve those that are indifferent, by endeavouring to obtain a knowledge of

from danger to its inmost recesses, where it cannot be incommoded by the heat of the fires upon the surface, small is the benefit produced by this operation. The fires are no sooner extinguished, than they begin their labours afresh with re-doubled assiduity, and thus frustrate the aim of the improver.

Thus it appears, that the season usually chosen for performing this operation is the most unpropitious.— If ever they are to be destroyed by cutting up the hills, the operation must be performed in summer, when the hills are their place of abode, and when many of them must be destroyed by this operation. But as they are so numerous, many must, even then, make their retreat to the bottom of their holes, and be preserved. If this operation, however, was performed about the end of June, or beginning of July, when the young of this animal are in their vermicular and aurelia state, and near the surface, the greatest part of these young ones would be destroyed;—which would be doing something. But when it is considered, that this creature multiplies so fast—that some of the vermicles and aurelias would be saved by the assiduous care of the working ants,—and that, of the living ants, perhaps, not one hundredth part could be by this means destroyed, it will be allowed, that even this operation, expensive as it must appear to be, is only a slight palliative at best; and that no effectual cure remains so adviseable, as ploughing the field up, or spreading a stream of water over the surface of it, which will, in all cases, destroy them most effectually.

such plants as might afford the most valuable pasture, and cultivating these with assiduity and care.

The inattention of the improving farmers in Great Britain to this subject, has been truly amazing. But it is hoped the attempt that has been made by the ingenious Mr. Stillingfleet, will be in time attended with the desirable effect of turning their attention to a subject of such great importance; with regard to which, they will then doubtless make many valuable improvements*. It is, however, to be feared, that till some attempt shall be made to ascertain the particular qualities and peculiarities of the different kinds of grasses, as is pointed out in the first and following Disquisitions in this Essay, the Public will be often imposed upon by specious accounts of new grasses, which

* Since the first publication of this Essay, the ingenious Mr. Marshall, Mr. Curtis, and several others, have adverted to this subject, and, no doubt, much benefit will be derived from their united labours. Many notions that were current at the time this Essay was originally written, are now thereby exploded, and improvements in this department are in the train of advancing. *Note to the fourth Edition.*

may be really possessed of few valuable qualities, and may very much tend to discourage the enquirer. This ought not, however, to prevent such as may have had an opportunity of making any observations on this subject, from communicating them to the public, as, they may always be of some use in helping to augment, in a small degree, the general stock of knowledge.

For this reason, I scruple not to communicate the following remarks relating to this subject, that have occurred to myself. At the same time, I beg leave to caution the reader, as well with regard to myself, as every other person who may write on this subject, to attend to what is said with some degree of diffidence; and not at once to indulge, without restraint, the pleasing ideas that may present themselves to his imagination on perusing these accounts: For, although the writer may be as ingenuous as possible, yet the mind is so apt to be hurried forward with too much precipitancy when it contemplates prospects of this sort, that it is next to impossible he should avoid falling into some mistakes,

mistakes, which time, and a more enlarged experience, will afterwards discover and correct.

In the mean time, it were much to be wished, that both the writer and reader would strenuously endeavour to discover what are the particular purposes for which any one plant could be deemed valuable, and in what respects it might be looked upon as of no value at all: For, as there is no plant that can be alike useful on all occasions, if we lose sight of this most necessary distinction, it may often happen, that we may attempt to rear a particular plant for purposes which it was never fitted to answer; and our want of success in these trials may make it be entirely rejected, even in cases for which it was extremely proper.

But this we may rather wish for, than hope to see faithfully put in practice at once: For the human mind is so apt to be dazzled with novelty, that when a new plant is introduced into Agriculture, like a new-discovered mineral-well, it is cried up as possessing every valuable quality. Every one is eager to experience its salutary

tary virtues. It is applied in all cases, and to all constitutions: But as soon as the rage for novelty is subsided, experience soon satisfies the greatest part of those who have tried it, that they have received no benefit from it; on which account, it is cried down, as possessing no virtues at all, and becomes entirely neglected, except by the few whose diseases it was fitted to relieve, who, in humble obscurity, reap the benefits thereof, and after a course of many years, perhaps, recommend it to the public notice for those real qualities alone that it indeed possesses.

Such has been evidently the case with regard to some plants that have been of late recommended to the attention of the public, in too sanguine a manner:—And such, I doubt not, may be the case with some of those that I here take notice of, although I have, at least, endeavoured to guard against it.

Rye-grass has been long cultivated in our fields; and it is now, in general, held to be but a very indifferent grass for pasture, on account of the tendency it has to send out numerous seed-stalks very early

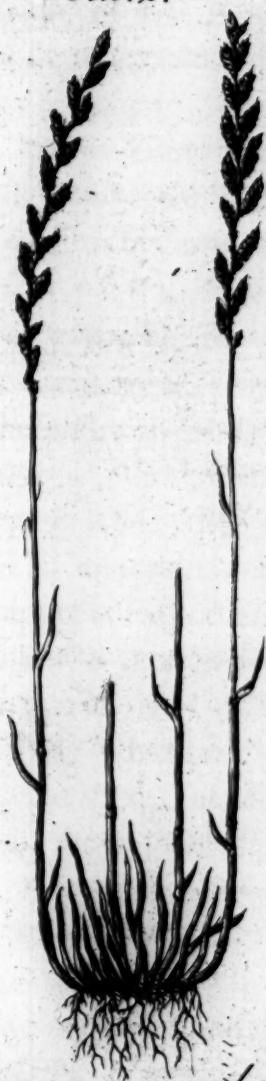
in the season, after which no animal will taste it; so that, unless it be for a very short while in the spring, when the leaves are tender and succulent, it is no longer fit for pasturage,—the stalks, after the month of May, becoming withered;—so that after that period, the field is usually covered entirely with these dead stalks; and remains, during the remainder of the season, with very few signs of vegetation of any sort. It is, moreover, but a short-lived grass, usually dying out entirely in five or six years. On both which accounts, it is by no means to be recommended, in general, as a proper grass for pasturage, unless under a careful management, and in circumstances which will be afterwards more particularly specified.

All grasses that run chiefly to seed-stalks, would seem to be, for the same reasons, in some degree, improper for that purpose; so that our researches ought to be directed principally to discover such grasses as run chiefly to leaves, and produce but few flower-stalks.

It was this quality that first recommended

p. 392.

Tab. 2.



J. A. del.

Ryegrass. vulgo

THE HISTORY OF THE

PROGRESS OF THE

ARTS AND MANUFACTURES

IN THE

WEST INDIES

FROM THE

DISCOVERY OF THE

ISLANDS

TO THE PRESENT

PERIOD

BY

JOHN BARROW

ESQ.

LONDON

PRINTED BY

mended the purple fescue-grass to the notice of the Writer of this Essay, and induced him to try some experiments with regard to it.

Botanists will readily know this plant. But, for the satisfaction of the farmer, it will not be improper to observe, that although this grass is very often found in old pastures, yet as it has but few flower-stalks, and as it is eaten greedily by all domestic animals, these flower-stems are seldom suffered to appear, so that it usually remains there unperceived. But it seems to be better able to endure the peculiar acrimony of the dung of dogs than almost any other plant, and is therefore often to be met with in dog-hills, as I call the little hills by road-sides, where dogs usually piss and dung; and as it is allowed to grow there undisturbed, the farmer may have an opportunity of examining the plant, and becoming acquainted with its appearance.

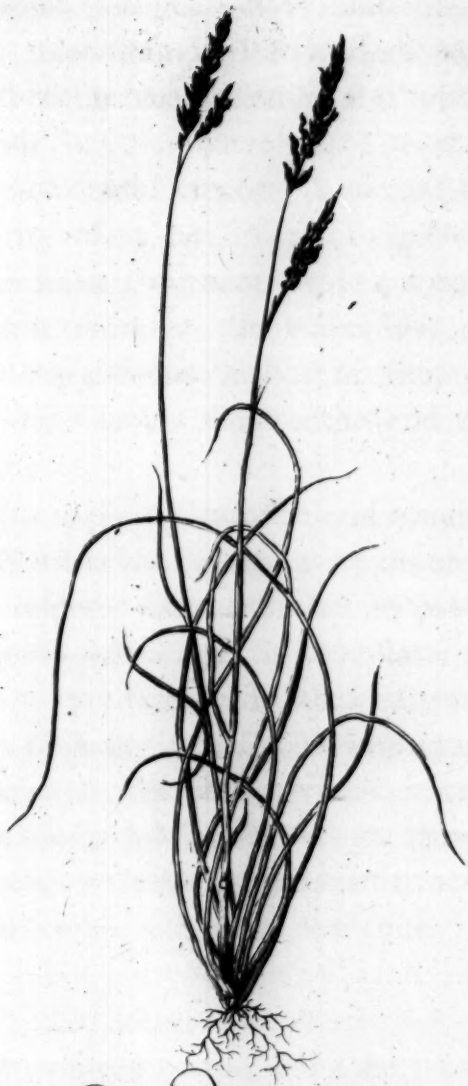
The leaves are long and small, and appear to be roundish, something like a wire. But upon examination, they are found not to be tubulated like a reed or rush,

rush, the sides of the leaf being only folded together from the middle rib, exactly like the strong bent-grass upon the seashore. — The flower-stalk is tall, and branches out in the head a little resembling the wild oat; only the grains are much smaller, and the ear does not spread full open, but lies bending a little to one side. The stalks are often spotted with reddish freckles, and the top of the roots are usually tinged with the same colour; from whence it has probably obtained its distinctive name of *Festuca rubra*, or red (purple) fescue.

It is often to be met with in old garden-walks; and as its leaves advance very quickly after cutting, it may usually be discovered above the other grasses about a week or fortnight after the walks are cut. — Nor do they seem only to advance at one season, and then stop and decay, but continue to advance during the whole of the summer, even where they are not cut, so that they sometimes attain a very great length. I some time ago measured a leaf of this grass that sprung up in a neglected corner, which was four feet and four inches

p. 398.

Tab. 3.



J. A. Del^r

Purple Fescue Grass

J. B. Sc

in length, although not thicker than a small wire.—It is unnecessary to add, that these leaves naturally trail upon the ground, unless where they meet with some accidental support; and that if any quantity of it be suffered to grow for a whole season, without being eat down or cut, the roots of the leaves are almost rotted by the overshadowing of the tops of the other leaves before the end of the season.

—This is the appearance and condition of the plant when in its native situation, as it is seldom discovered but in pretty old pastures.—And as it, in that state, carries only a very few seed-stalks, it was with some difficulty that I could collect a small handful of the seed, which I carefully sowed in a small patch of garden-mould, to try if it could be easily cultivated.—It came up as quickly as any other kind of grass, but was at first as small as hairs:—the leaves, however, advanced apace, and were, before autumn, when the grain along with which they had been sowed was cut down, about sixteen or eighteen inches in length; but having been sowed very thin,
it

it was necessary to pick out some other kinds of grass that came up amongst it, lest it might have been choaked by them. Early next spring, it advanced with prodigious vigour, and the tufts that were formed from every seed became exceedingly large, so that it quickly filled the whole ground. But now the leaves were almost as broad as those of common rye-grass, and the two sides only inclined a little towards one another from the mid-rib, without any appearance of roundness.— In due time, a great many seed-stalks sprung out, which attained very nearly to the height of four feet, and produced seeds in abundance, which may be as easily sowed as those of common rye-grass.

The prodigious difference between the appearance of this plant in its native and cultivated state, amazed me; but it was with a good deal of satisfaction that I found there would be no difficulty in procuring seeds from it, which I had much doubted of at first. It would seem that Nature hath endowed this plant with a strong generative power during its youth, which it gradually loses as it advances

vances in age (for the difference perceived in this case could not be attributed to the richness of the soil); and that, on the contrary, when it was old, the leaves advanced with an additional vigour, in proportion to the declining strength of the flower-stalks. For the leaves of the young plant seldom exceed two feet, whereas numbers of the old leaves were near four feet in length.

From these peculiarities in the growth of this plant, it would seem to promise to be of great use to the farmer, as he could reap from a field of it, for the first two or three years, as great a weight of hay as he could obtain from any of the culmiferous grasses; and if he meant afterwards to pasture it, he would suffer no inconveniences from the flower-stalks; and the succulent leaves that continue to vegetate with vigour during the whole summer, would at all times furnish his cattle with abundance of wholesome food: It has been already remarked, that this grass rises as early in the spring as rye-grass, and continues green for the greatest part of winter, which the other does not.

—It

—It is, moreover, an abiding plant, as it seems never to wear out of the ground where it has been once established. On all which accounts, it appears to me, highly to merit the attention of the farmer; and well deserves to have its several qualities, and the culture that best agrees with it, ascertained by accurate experiments*.

I have likewise taken some notice, on a former occasion, of another kind of native grass of this country, that has a just claim to a more particular share of the farmer's attention, than it has ever yet obtained among us, *viz.* the sheep's fesc-

* Since the above was written, I find little reason to alter any thing that has been here said. In a few years, I found that this grass, where it had been sowed, produced but few seed-stalks; the pile of grass became extremely close, and the plants advanced in height with less luxuriance, and were drier and less succulent, than during the first two or three years. It appears to me, that in consequence of its great increase by the roots, it will have a tendency to become, in time, too thick, so as to stint the plants in their growth; so that harrowing from time to time with very weighty harrows, or some other practice, by which a good many of the plants might be eradicated, would prove of use to renew the vigour of the grass.

cue-

cue-grass (*Festuca ovina*) so much praised by the Swedish naturalists, for its singular value as a pasture-grass for sheep; this animal being represented as fonder of it than any other grass, and fattening upon it more quickly than on any other kind of food whatever. And, indeed, the general appearance of the plant, and its peculiar manner of growth, seem very much to favour the accounts that they have given us of it.

This plant is of the same family with the former, and agrees with it in several respects; although they may be easily distinguished from one another.—Its leaves, like the former, in its natural state, are always rounded, but much smaller, being little bigger than large horse-hairs, or swine-bristles, and seldom exceed six or seven inches in length. But these spring out of the root in tufts so close upon one another, that they resemble in this respect a close hair-brush, more than anything else that I know; so that it would seem naturally adapted to form that thick short pile of grass, in which sheep are well known chiefly to delight.—Its flower-
stalks

stalks are numerous, and sometimes attain the height of two feet; but more usually about twelve or fifteen inches high.

Upon gathering the seeds of this plant, and sowing them as the former, it was found, that they sprung up as quickly as any other kind of grass; but the leaves are at first no bigger than a human hair.—From each seed, springs up one or two of these hair-like filaments, that in a short time send out new off-sets, so as quickly to form a sort of tuft, which grows larger and larger, till at length it attains a very large size, or till all the intervals are closed up; and then it forms the closest pile of grass that it is possible to imagine.—In April and May, it pushed forth an innumerable quantity of flower-stalks, that afforded an immense quantity of hay; it being so close throughout, that the scythe could scarcely penetrate it. This was allowed to stand till the seeds ripened; but the bottom of the stalks were quite blanched, and almost rotted for want of air, before that period.

This was the appearance that it made
the

p. 400.

Tab. 4



J. A. del.

Sheep's Fescue Grass

the first year after it was sowed: But, I have reason to think, that after a few years, *it* likewise produces fewer feed-stalks, and a greater quantity of leaves, than at first. However that may be, it is certain that if these stalks are eaten down in the spring, it does not, like rye-grass, persist in a continual tendency to run to seed; but is at once determined to push forth an abundance of leaves, without almost any stalks at all*. And as all domestic animals, but more especially sheep, are extremely fond of this grass, if they have liberty to pasture where it grows, they bite it so close as never to suffer almost a single feed-stalk to escape them; so that the botanist will often search in vain for it, when he is treading upon it with his feet.—The best way to discover it in any pasture, is, to search for it in winter, when the tufts of it may be

* From this peculiarity, it necessarily happens, that if sheep are allowed to pasture on this grass in the spring, few or no seeds can be expected from it that season: Plants intended for seeds ought, therefore, to be preserved carefully from cattle or sheep in the winter or spring.

easily distinguished from every other kind of grass, by their extraordinary closeness, and the deep green colour of the leaves.

It seems to grow in almost any soil, although it is imagined that it would flourish best in a light spongy soil, as it can evidently live with less moisture than almost any other kind of grass, being often seen to remain in the fods that have been employed for coping stone dykes, after all the other grasses that grew in them have disappeared. It is likewise frequently found on poor barren soils, where hardly any other plant can be made to grow at all; and on the surface of dry worn-out peat-moss, where no moisture remains sufficient to support any other plant whatever.—But in neither of these situations does it thrive; as it is there only a weak and unsightly plant, very unlike what it is when it has the good fortune to be established upon a good soil, although it is seldomer met with in this last than in the former.

From this last circumstance, it appears, that those who imagine that a plant is

ON AGRICULTURE. 211

always found naturally on that soil in which it most delights, and where it will grow to the utmost perfection, may be very often deceived;—as some particular circumstance relating to the economy of the plant, may prevent it from being able to establish itself in the soil in which it would thrive better than any where else, if it could have overcome those obstacles that prevent its establishment there;—and that, on the contrary, it may naturally appear on other less favourable soils, merely because it does not in these meet with the same obstructions to prevent its establishment there.—This, I am satisfied, is exactly the case, with regard to the sheep's fescue. For, as its first shoots are extremely weak, it is then easily surmounted by almost every other kind of plant.—And as the seeds of other kinds of grass that may chance to be lodged in a rich soil, rush up with vigour, and soon cover the whole surface of the ground, the few seeds of this kind of grass that may chance to be carried into these fields, are hardly allowed to vegetate, before

they are entirely smothered by the other stronger grasses.

But upon such barren soils as are unfit to rear any other kinds of grass, the seeds of this plant are allowed to come up, and the plants to grow, without meeting with the same obstruction; and there they establish themselves, from this cause, although the soil is incapable of affording them afterwards that abundant nourishment which is necessary to rear the plant to perfection.

I chose to remark this peculiarity relating to this particular kind of grass, not only to satisfy the reader of the necessity of attending to many seemingly trifling circumstances relating to the œconomy of particular plants, but also to guard against a prejudice that might arise in the minds of some people, who might chance to take notice of this plant in the situation that I have now described; where, finding it so unlike that thriving state in which I have represented it in other passages of this article, they might be disposed to doubt the truth of what I have alleged.—But if they wish to satisfy themselves

in

in this respect, let them either transplant a few tufts from these barren soils into a good garden-mould, or sow the seeds there, and guard against their being choaked with others, and they will soon see how different the one plant is from the other.

From this fact, we may likewise draw the following very useful corollary:—That seeing it is so difficult to meet with a good rich soil in such circumstances as to permit this plant naturally to establish itself in it,—and seeing we have very great reason to imagine that this is one of the most valuable grasses our country produces, we have, from this single instance, the clearest proof that could be wished for, of the impossibility of obtaining, on all occasions, the finest pasture, by allowing Nature to operate without any assistance.

—Heaven has endowed man with reason, that by the exercise thereof, he may promote his own felicity; and hath subjected many of those objects that may minister to his wants, to particular natural inconveniences, which it is in his power to remove, and thus render them more eminently useful to him;—of which, this may

214 DISQUISITIONS

be looked upon as one conspicuous example:—For, by saving the seeds of this plant, and sowing them in sufficient quantities, on a rich soil, properly prepared, the great number of plants that are thus established before the seeds of others can be brought to the field, and made to vegetate, effectually cover the whole surface, and exclude the admission of others; so that we may thus have a full crop of this valuable plant upon a soil in which Nature could hardly ever have established it, and in which alone it can ever arrive at its ultimate perfection.

It may not, however, be improper to remark, as one of the excellences of this plant, that it will grow upon such soils as hardly any other good kinds of grass could live upon. And although the farmer cannot from these expect a crop nearly equal to what he will reap from his richer fields, yet it is no small convenience for him to have a plant with which he can at once cover his most barren spots, which, without this care, might have remained bare for many years.

I will not here repeat what has been
already

already said, about the particular property that this plant possesses of continuing green all winter, nor point out the benefits that the farmer may reap from this valuable quality.—He need, not, however, expect to find any verdure in winter, on such plants as grow upon the loose mossy soil above mentioned: For, as the frost in winter always hoves up the surface of this soil, the roots of the plants are so lacerated thereby, as to make them remain for some time in the spring to all appearance dead.—Nor will he often perceive much verdure in winter, upon those plants that grow upon poor hungry soils, which cannot afford abundant nourishment to keep them in a proper state of vegetation at all times.—But such plants as grow on earthen dikes, which usually begin to vegetate with vigour, when the autumnal rains come on, for the most part, retain their verdure at that season, almost as well as if they were in good garden-mould.

I have been very particular with regard to this plant; because, in so far as my observations have yet gone, it promises, on many accounts, to make a most valuable

acquisition to the farmer, and, therefore, justly demands a very particular share of his attention*.—

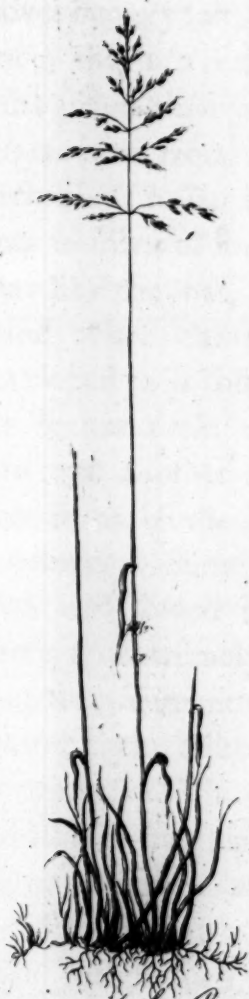
Another very valuable pasture-grass, is what I would call the vernal soft-grass,—the *poa trivialis*, or creeping meadow-grass.—No grass makes a more beautiful appearance in the spring than this does.—The lively verdure and closeness of the pile, and the softness and succulent richness of the leaf, convey the most pleasing idea to the mind that could be desired, and seem to give it a just title to be considered as one of the most valuable kinds of meadow-grasses.

It delights so much in moisture, that it is seldom found on dry ground, unless the soil is exceedingly rich.—It is often found upon those patches near springs, over which the water frequently flows, and may be easily known by the uncommon softness and succulence of the blade, the lively

* I find, that, even in a rich soil, this plant, after a few years, does not advance with very great luxuriance, the pile becoming so close as to check its growth. For this reason, it is always a dry pasture, much fitter for sheep than cattle,

p. 410.

Tab. 5.



J. A. del.

Creeping Soft Grass

A. B. Sc.

light-green colour of the leaves, and the matted intertexture of its roots. But, though its first leaves be very soft, when the seed-stalks advance, they are rough to the touch; so that the plant then assumes a very different appearance from what we would have expected.—The ear is branched out into a great number of fine ramifications, somewhat like the oat, but infinitely smaller; and when the seeds are ripe, they are enveloped in a soft kind of membrane, that makes them adhere to the stalk, and to one another after they are separated from it, as if they were intermixed with cobweb. Some of these seeds were saved, and sowed by themselves, which came up extremely well;—but on account of that filamentous membrane which makes them adhere to one another, it is extremely difficult to get them to spread readily in sowing; and as the seed is small, and adheres very closely to the stalk, it is difficult to get it separated from thence. On both which accounts, it seemed to me, that it would not be easy to cultivate it artificially.—But if any contrivance could be got to clean the seeds, at a moderate

a moderate expence, a very small quantity of these would probably be sufficient to stock a rich meadow with it: For, although it were sowed very thin, it spreads so fast by its running roots, as would in a short time stock the field abundantly.

Another plant, that promises, on some occasions, to afford a valuable pasture-grass, is the bulbous foxtail-grass,—the *Alopecurus bulbosus*.—Its leaves are broad, soft, and succulent, and feel a little woolly to the touch. These spring out in great abundance from a strong, firm, matted kind of root; and if they are cut over at any time during summer, they very quickly advance again, so as to get above almost all the other kinds of grasses.—The seed-stalk is long, and very strong, being between four and five feet high, and is crowned with a round brush-like soft head, which consists almost entirely of light scaly-like seeds.—But, like the purple fescue, it sends out but very few flower-stalks; so that a crop of it allowed to come to seed, assumes but a very thin, straggling, and unsightly appearance.—In other respects, it much resembles the whole plant
lately

p. 412.

Tab. 6.



J. A. Del^l Bulbous Foxtail grass

lately introduced from America, known by the name of Timothy-grass,—only its leaves are softer, and of a darker green colour,—and the head is likewise soft and scaly, instead of being hard, and in some degree prickly, as is the case with Timothy-grass. The seeds also are exceedingly soft and chaffy, very unlike the firm round seeds of Timothy-grass.

It seems to delight chiefly in a moist soil, and therefore promises to be only fit for a meadow pasture-grass. The quality that first recommended it to my notice, was the unusual firmness that its matted roots gave to the surface of the ground, naturally soft and moist, in which it grew; which seemed to promise that it might be of use upon such soils, chiefly in preventing them from being much poached by the feet of cattle which may pasture upon them.—Mossy soils * especially are so much hurt by poaching, that any thing which promises to be of use in preventing it, deserves to be attended to.

* By mossy soils is here meant such as contain turf or peat. The Irish would call these bogs.

The seeds were sowed in garden-mould, and came up very well; but I have not yet obtained a sufficient quantity of these, to try how it would answer for the purpose that I had chiefly in view when I thought of cultivating it. I have remarked, that the stalks of this plant are extremely tough and flexible when made into hay, so as to be better fitted for making ropes for fastening thatch with, than any other plant I have yet seen.

If my experience with regard to Timothy-grass had been sufficiently extensive to enable me to speak of its qualities with certainty, I would have here enumerated them. But having found no reason, from the trials that I made of it, to think that it promised to be of very great value; and being sensible, that the attention of the public was already directed towards it, I left others to make the necessary experiments with regard to it.—And I only mention it here, lest some might have thought it an omission.

The great meadow-grass,—the *Poa pratensis*, seems to approach, in many respects, to the nature of the purple-fescue,

p. 418

Tab. 7.



J. L. L. L.

Great Meadow Grass

fescue, only that its leaves are broader, and not near so long, being only about a foot or sixteen inches at their greatest length. —Like it, it produces few seed-stalks, and many leaves, and is an abiding plant: But I have not yet had an opportunity of trying the effects of culture upon it, having only sowed the seeds of it, for the first time, last season.

The creeping meadow-grass, the *Poa repens*, seems to be the most valuable grass of any of this genus. Its leaves are firm and succulent—of a dark Saxon-green colour, and grow so close upon one another as to form the richest pile of pasture-grass. —The flower-stalks, if suffered to grow, appear in sufficient quantities; but the growth of these does not prevent the growth of the leaves, both advancing together during the whole summer; and when the stalks fade, the leaves continue as green as before*. —Its leaves are much larger,

* Culmiferous grasses might be divided into two general classes, for the purposes of the farmer, that it might be of use for him to attend to, viz. 1st. Those which, like the common annual kinds of corn, run chiefly

larger, and more abundant than the common meadow-grass, *Poa trivialis*, and therefore it deserves to be cultivated.—This description is taken from the plant in its native state.—How it may be altered by culture, I know not.

I have attempted to save some seeds of this plant for two years successively; but have never been able to get them in any other way than by gathering with the hand, which is a troublesome and tedious operation: And if the season is rainy, or the ground on which the grass grows is very rich, it is difficult to obtain the seeds even in this way: for, as in these cases the leaves continue to grow with luxuriance,

chiefly to seed-stalks; the leaves gradually decaying as these advance towards perfection, and become totally withered, or fall off entirely, when the seeds are ripe. Rye-grass belongs to this class, in the strictest sense: to it likewise may be assigned, the vernal grass, dog-tail-grass, and fine bent-grass.—2d, Those whose leaves continue to advance even after the seed-stalks are formed, and retain their verdure and succulence during the whole season, as is the case with the Fescue and *Poa* tribe of grasses, whose leaves are as green and succulent when the seeds are ripe, and the flower-stalks fading, as at any other time.

they

p. 416.

Tab. 8.



Creeping Meadow Grass

J. A. del

A. B. sculp

they soon overtop the seed-stalks, and, of consequence, the leaves being so close upon one another, both the leaves and stalks are often rotted before the seeds come to perfection.

This is perhaps one of the most valuable kinds of pasture-grass, and therefore merits a more than ordinary degree of attention, to try if the seeds can be obtained in such quantities as to be useful to the farmer.—It appears to me, that the only probable way of succeeding in this attempt, will be, to sow some of the seeds upon a clean sharp piece of ground, naturally dry, and not very rich at the time. If it were once established on such a soil, it would carry abundance of seeds every season, and there would be little probability that it would be rotted before the seeds were ripe : But as the leaves are for the most part higher than the stalks before the time of cutting, and as these leaves are extremely succulent when cut, it will be proper to make the whole of this scanty crop into hay,—put it up in a rick till the spring, and then thresh it out. The seeds are light and chaffy, and are neither easily separated

separated from the stalk, nor disentangled from the hay; so that care must be taken that the threshing and shaking are carefully performed. Or, what would be better—cut the hay, by means of a chaff-cutter, as small as it can be done, and strew the whole thinly over the field. As it is an abiding grass, it is worth being at some expence and trouble, to get it once firmly established.

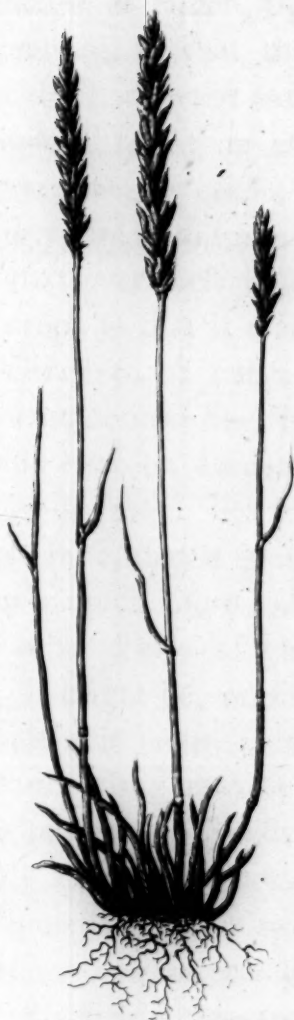
These observations are, in some measure, applicable to all the grasses of the *Poa* tribe*.

I have already mentioned the vernal-grass, and the use that I apprehended it might be of for giving a rich flavour to milk or butter:—But if, upon trial, it shall not be found to possess that quality, it does not, on any other account that I have as yet observed, much deserve the attention of the farmer.—As a pasture-grass, it seems to be subjected to all the

* The leaves of all the species of *Poa* grasses are remarkably tender and succulent, which renders them peculiarly proper food for cattle, as this class of animals delight as much in succulent food, as sheep do in dry pastures. The seeds of the whole tribe are entangled together, by the cobweb-like filaments already noticed.

p. 417.

Tab. 9.



A. delin.

Vernal Grass

inconveniences of the common rye-grass; because, like that, it runs almost entirely to flower-stalks, very early in the season, during the formation of which, the leaves are totally exhausted, so that the cattle must either eat these, or want entirely.—Its leaves do, indeed, spring up after it is cut over, or eaten down by cattle, and remain green pretty late in autumn: but it does not seem that ever these will yield a very abundant crop; so that it would probably require either to be cut and consumed green, or made into hay, like rye-grass, if it should ever be deemed worth the cultivating.—It may, however, be remarked, in its praise, that it grows with luxuriance upon a much more indifferent soil than many other kinds of grass; on which account, it might be, on some occasions, of considerable value.

Nearly the same thing may be said of the crested dogs-tail-grass (*Cynosurus cristatus*) commonly known, in Scotland, by the name of Windlestraw-grass, excepting that it possesses no uncommon taste or smell; but, like the former, it runs chiefly to stalks, and has but few leaves, which

are short; and remain green pretty late in Winter.—I have gathered some of the seeds of both these, and shall soon be able to speak of them with a greater degree of certainty*.

I am well acquainted with the fine bent-grass†, so much recommended by Mr. Stillingfleet, in his Essays; but think it is, by no means, of such uncommon value, as he seems to imagine.—Cattle and horses will eat it, when pinched for food; but it is with difficulty they can be kept upon a field where this grass chiefly abounds; so that they will leave it if they can, and go to other fields, much barer, that contain more palatable grasses; nor do they almost ever grow fat upon it; and therefore, I would not recommend it to the improving farmer. Nor does it appear to me, that the flote-fescue is of half the value that he has been made to believe.

I was also at pains to get some seeds of

* From a peculiarity of circumstances, not necessary to be here enumerated, the author found it impossible to prosecute his experiments on these grasses.

† *Agrostis Tenussima*.

p. 418

Tab. 10



Crested Dogtail Grass

J. A. delin.

J. A. B. sculp.

the American Cocks-foot-grass* that was lately advertised, as of inestimable value. Like all the other grasses of this tribe, it is a strong robust plant.—Its leaves are broad, firm, and roughish, of a light green colour, but neither are very long nor close upon one another:—its stalks rise thin and straggling;—are strong, and feel rough to the touch,—rising to the height of near four feet, on a good soil.—It does not promise either to yield an abundant crop of hay, nor a close pile for pasture;—nor does its appearance seem to indicate that it would be of the most palatable sort for cattle.—The quantity I have is too small to permit me to speak with great certainty.—It seems to be a plant that would require a dampish soil.

All these belong to the class of culmiferous plants, and are what Botanists call *Gramina*, or grasses properly so called. But as there are many other plants that may be employed by the farmer for the same uses as these, it is by no means necessary that he should confine himself to

* *Dactylus Americanus*.

this class of plants alone, or be directed in his researches by any other rule excepting that of utility.—The following plants, therefore, are pointed out to him, as promising to be of some use on particular occasions.

Milkwort, as it is called in some parts of this country, the *Coronilla Corniculata* of Hudson, is a plant common in every part of the island, although it has never yet, that I have heard of, been attempted to be cultivated.

The general appearance of this humble plant, is, in some respects, very like that of the common white clover, although its leaves, upon a nearer examination, are not exactly similar to those of this plant.—From the top of the root, there comes out, in the spring, a great number of small shoots, that spread along the surface of the ground, every way around it; from which arise a great many clusters of bright yellow flowers, exactly resembling those of common broom, in shape, size, and colour; which are succeeded by hard round pods, filled with small kidney-shaped seeds. And as three or four of these pods usually

p420

Tab. II.



J. A. del.

Milkwort

A. Bell. sculp.

usually adhere to one foot-stalk, from which they spread open at the points, a little resembling the fingers of an open hand, they have, from this circumstance, been, by the vulgar, in some places, called Ladies-fingers*; while others, more struck with the resemblance that these pods bear to the foot of a bird, have distinguished it by the name of Crow-toes†; and others, from the appearance of the blossom and the part where the plant is found, have called it *feal*‡, or, by corruption, *fell-broom*.

It is found plentifully almost everywhere in old grass-fields; but as every

* The reader will please to observe, that this is not the plant which properly bears the English name of Ladies-fingers—the *Anthyllis* of Botanists.

† Neither is this the plant that bears the name of Crow-foot, properly, in English—which is the *Ranunculus* of Botanists.

‡ If any sod is dug from the surface of the ground, in which a root of this plant chanceth to be, and it be put upon the top of a sunk-fence wall, or in any other place that is not entirely destitute of moisture, the plant does not die, but sends out annually great tufts of flowers, which were not, perhaps, observed on the pasture from which the sod (*feal*) was dug, which probably first suggested the idea of that name.

species of domestic animal eats it almost in preference to every other plant, it is seldom allowed to come to the flower in pasture-grounds, unless where they have been accidentally saved from the cattle for some time; so that it is only about the borders of corn-fields, or the sides of inclosures to which cattle have not access, that we have an opportunity of observing it. As it has been imagined that the cows which feed on those pastures where this abounds, yield a great quantity of rich milk, the plant has, from that circumstance, obtained its most proper English name of milk-yetch.

But the circumstance that first recommended it to my notice, was, the having observed that it grows and flourishes in poor barren ground, where scarcely any other plant can be made to live. I have seen it in the midst of a barren moor, where the soil was so poor, that even heath, or ling (*erica communis*) could hardly grow; and upon bare obdurate clays, where no other plant could be made to vegetate; insomuch, that the surface remained entirely uncovered, unless where
a plant

a plant of this kind chanced to be established: yet, even in these unfavourable circumstances, it flourished with an uncommon degree of luxuriance, and yielded as tender and succulent, though not such abundant shoots, as if they had been reared in the richest-manured fields.—I have likewise seen it in dry and barren sands, where scarcely any other plant could be made to live; and there also it sends out such a number of healthy shoots all round, as cover the earth with the closest and most beautiful carpet that can be desired.

The stalks of this plant, as has been said, are weak and slender; so that they spread upon the surface of the ground, unless they are supported by some other vegetable. In ordinary soils, they do not grow to a great length, nor produce a great many flowers; but in richer fields, the stalks grow to a much greater length, —branch out a good deal, but carry few or no flowers or seeds; and as I first took notice of it only on poor soils, it was purely with a view to pasture that I first resolved to cultivate it; and, with this intention,

intention, sowed it with my ordinary hay-seeds, expecting no material benefit from it, till I desisted from cutting my field; but found myself agreeably disappointed, as it grew the first season as tall as my great clover, and formed the finest hay I ever saw,—it being scarcely distinguishable from Lucerne, but by the slenderness of the stalk, and proportional smallness of the leaf.

It is nearly allied to Lucerne, in its botanical characters, and resembles that valuable plant, in many other respects.—Like that, it is perennial,—sends down a long root, to a great depth in the soil, which is at first small, and gradually increases with age, till it at length becomes of a very considerable size; so that it is several years after it is first sowed, before it attains its full perfection: But when it is once established, it probably remains there for a prodigious number of years, in full vigour, and produces annually a great quantity of fodder. In autumn, 1773, I cut the stalk from an old plant of it that grew in a very indifferent soil; and after having dried it thoroughly, found that it weighed

weighed fourteen ounces and a half. Like Lucerne, it is never affected with the severest droughts that we experience: But it does not resemble that plant in delicateness of constitution, as it thrives in the stiffest clays, and is able to stand its ground among grass, or any other weeds.

As this plant only produces seeds in abundance upon poor hungry soils, that could hardly afford nourishment to any other, and as the stalks spread out close upon the surface of the ground, it seems to me, that the greatest bar to the cultivating thereof, will be the difficulty of obtaining the seeds in abundance, as, in these circumstances they must always be gathered by the hand. But as it is an abiding plant, those who have such soils as most stand in need of having plants of this sort sowed upon them, may be at a little trouble and expence to get them at once *properly* laid down with this grass, as it will be only once that they will need to do it. It is possible, that future experience may discover some easier way of procuring the seeds than hath as yet occurred to me.

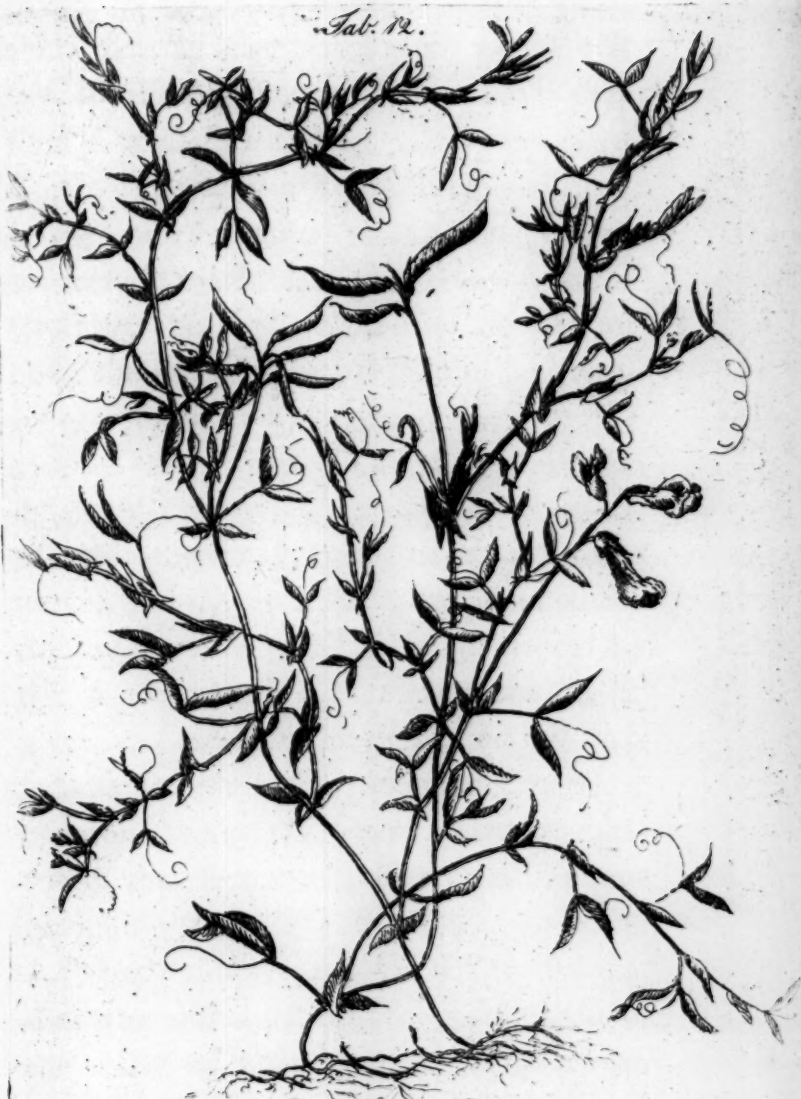
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The stalks of this plant die down entirely in winter, and do not come up in the spring till the same time that clover begins to advance, so that it can never be of use but as a summer-pasture.—Neither does it advance very fast after it is cut down, or eaten over, even in summer; but the great closeness of the shoots may probably counterbalance that defect.

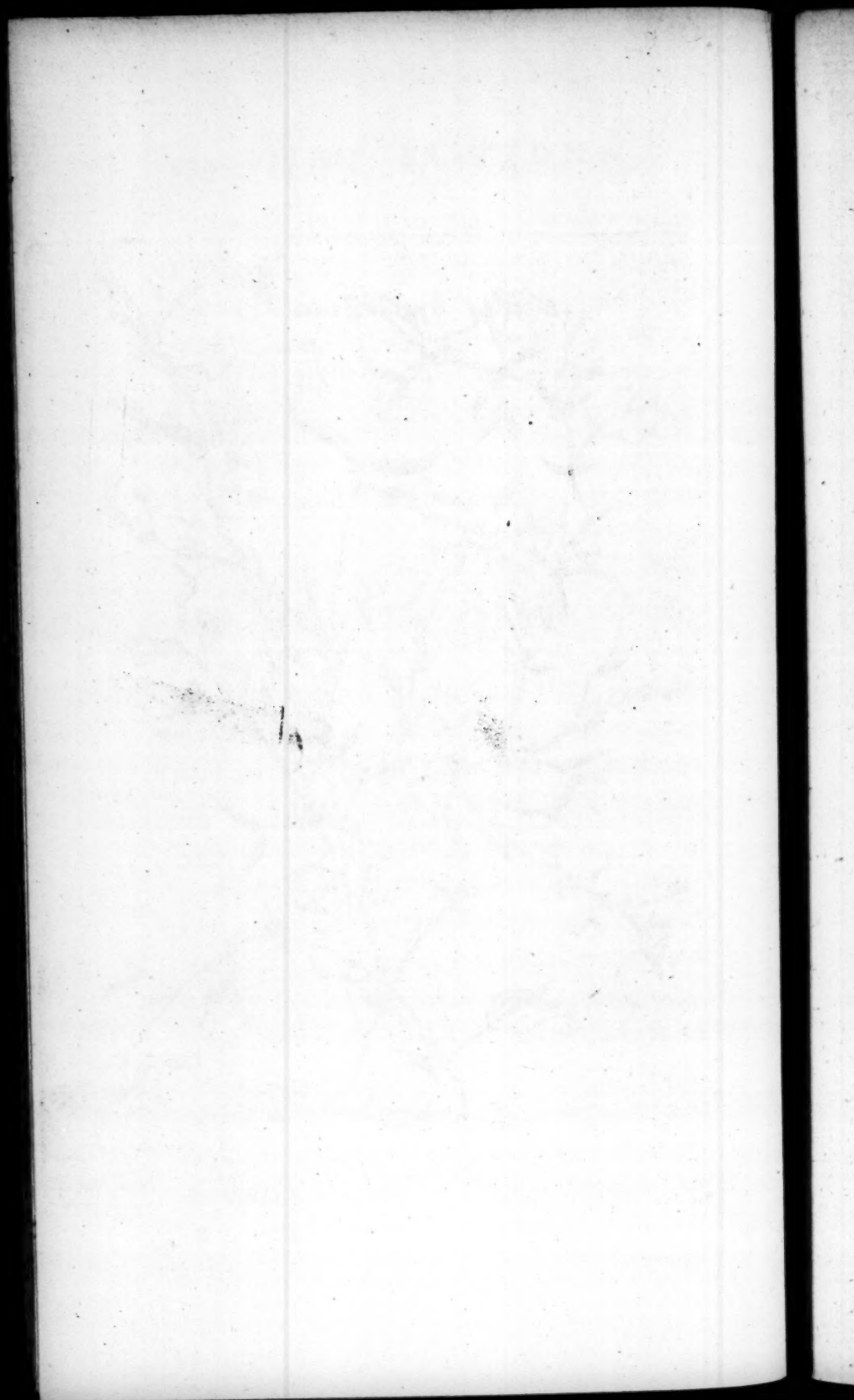
I have seen another species of the *astragalus*, with an erect stalk, that naturally grows upon dampish soils; but have had no opportunity of making particular observations upon it, nor have as yet been able to procure any of its seeds. It seems more likely to answer well for hay than this does, as its stalks are longer.

The common yellow vetchling, *Lathyrus pratensis*, or everlasting-tare, might likewise be, on many occasions, cultivated with profit by the farmer.—It grows with great luxuriance in stiff clayey soils, and continues to yield annually, for any length of time, a great weight of forage, which is deemed to be of the very best quality. And as it is equally fit for pasture or for hay, the farmer would have it in his power

Tab. 12.



Yellow Vetchling



power to apply it to one or the other of these uses, at any period that might best suit his convenience.—It is likewise attended with this farther advantage, that as it continues to grow with equal vigour in the end of summer as in the beginning thereof, it would admit of being pastured upon in the spring, till the middle, or even the end of May, should it be necessary, without endangering the loss of the crop of hay; which cannot possibly be done with rye-grass, or any other plant usually cultivated by the farmer, except clover, which is equally unfit for early pasture or for hay.—This plant would be the more valuable to the farmer, as it grows to the greatest perfection on such soils as are altogether unfit for producing sain-foin, the only plant hitherto cultivated, that seems to possess qualities approaching to those of this one.

It must, however, be acknowledged, that the difficulty of procuring seeds of this plant in abundance, must be a very great bar to the general cultivation thereof: For although these ripen very well in our climate, yet the quantity that it produces

duces is so inconsiderable, and the difficulty of getting them separated from the pod, is so great, as to make it necessary to gather them by the hand; in which way the quantity obtained must be very trifling. To counterbalance this defect, however, it may be observed, that it is not only an abiding plant, which never leaves the ground where it has been once established, but that it also increases so fast by its running roots, that a very few plants at first put into a field, would soon spread over the whole, and stock it sufficiently.—If a small patch of good ground be sowed with the seeds of this plant in rows about a foot distance from one another, and the intervals be kept clear of weeds for that season, the roots will spread so much as to fill up the whole patch next year, when the stalks may be cut for green-fodder, or for hay. And if that patch were dug over in the spring following, and the roots taken out with the hand, it would furnish a great quantity of plants, which might be planted in such fields as you meant to have filled with this, at the distance of two or three feet apart;

apart; which would probably there take root, and quickly overspread the whole field.—And as there might always be a sufficient quantity of the roots left to fill again the patch, from whence they are taken, it would be ready to furnish a fresh supply the next season, and might thus continue to serve as a nursery for ever afterwards.

It appears to me, that this would be the most likely method of propagating this plant with ease: but I have not as yet had sufficient experience thereof, to be able either to tell precisely the expence of it, or to answer positively for the success thereof in all cases*.

The flowers of this kind of vetch, grow in a wide spike, having pretty long foot-stalks;—are of a bright yellow colour, and are succeeded by very flat pods, which are black when ripe, that are so tough, and adhere so firmly to one another, that they are with difficulty opened;—the seeds are flat,—small, of a dark greenish grey colour,—and irregular figure;—round for the most part.

* Since the above was written, I have tried to cultivate it in this manner, and found it succeed.

The common blue tare, is, in many respects, of seemingly equal value with the former.—This carries a large clofs spike of bright cerulean-coloured flowers, which are succeeded by smooth white pods, filled with round flatted blackish seeds, which rattle in the pods when ripe.—The leaves of this plant are much smaller, and more divided than those of the former; the stalks are likewise smaller, and grow to a much greater length.—It produces a much greater quantity of seeds; but the small birds are so fond of them, that unless the field is carefully guarded, few of the seeds are allowed to ripen; but if they were preserved from that enemy, they might be easily propagated.—It seems to flourish on the same soil with the former,—is equally well liked by cattle, and will probably afford a more nourishing hay, on account of the quantity of seeds it contains:—But as the stalks come up more thinly from the root, and branch more above, it would not seem of itself to be so well fitted for a pasture-grass as the former. If it were intermixed with other plants, that made the pile clofs at the bottom, it might probably greatly increase the value of the pasture,

p. 430

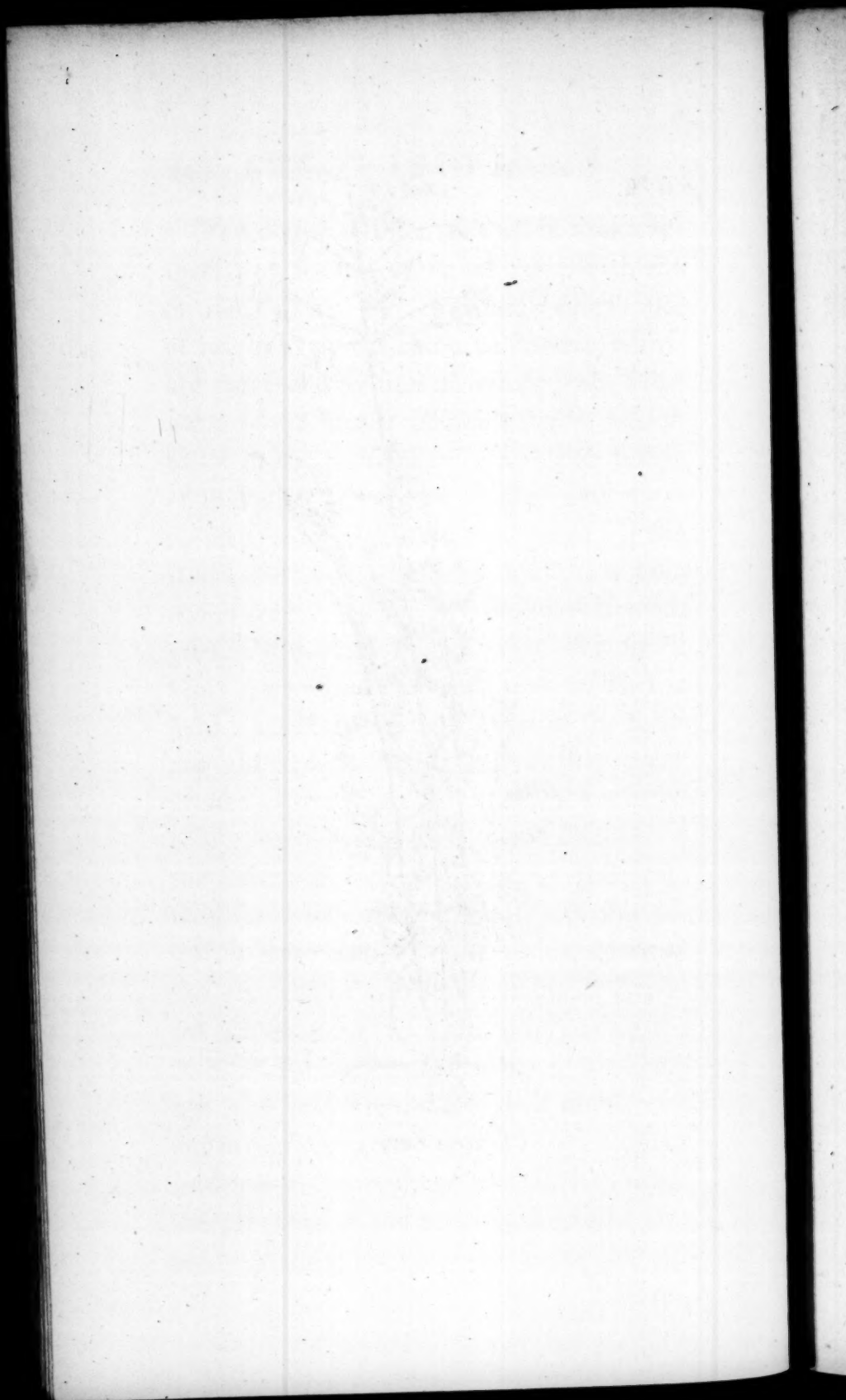
Tab 13



Blue Tare

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pasture, and would put it in the power of the farmer to cut a very fine crop of hay from his fields, at any time he might so incline.

It is often found growing among the corn, in stiff soils badly dressed, where its roots are allowed to remain; and is known in some parts of Scotland, by the name of *horse-peas*.

But of all the plants of this tribe that have occurred to me, none seem to equal the purple everlasting, or bush-vetch (*Vicia sepium*) for pasture.

The roots of this plant spread on every side, a little below the surface of the ground, like both the former; from which arise many stems in the spring of the year, quite close by one another. And as these have a broad-tufted top, covered with many leaves, it forms a pile, even without any other plant, as close as could be desired.—It does not grow to a very great height; and as it springs up very quickly after being cut or cropt, it seems to be more properly adapted for pasturage than for hay; although it will grow to a sufficient height for that purpose on a good soil. But as the stalks grow so close upon

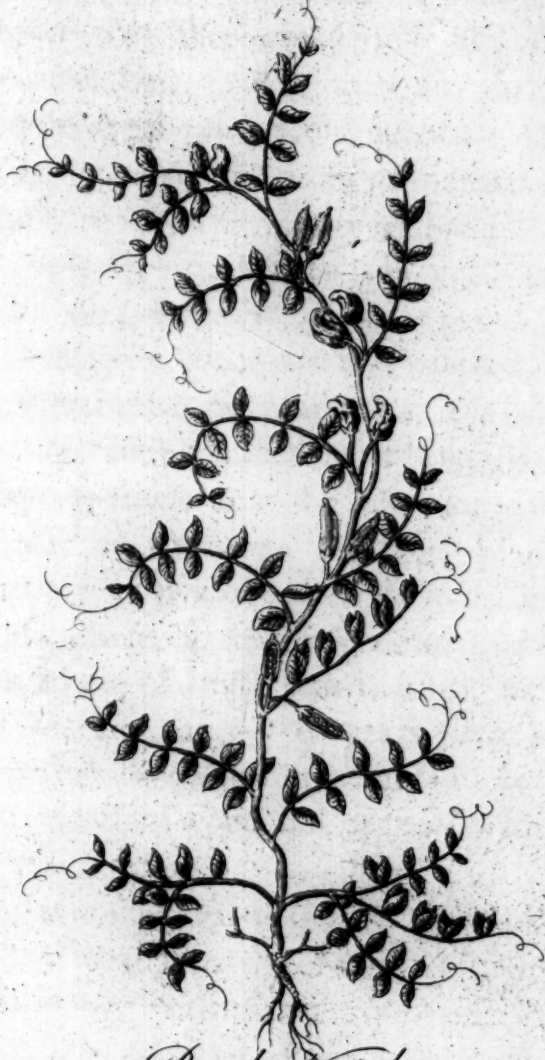
one another, there is great danger of having it rotted at the root, if the season should have a tendency to dampness.—It produces abundance of seeds, which could be saved with less difficulty than either of the former; were it not that they are very apt to be eaten by a worm, while yet in the pod, which often destroys them entirely. Clay seems to be the soil that it most affects. I know no plant that would be more valuable than this, as a food for beasts, could it be propagated with ease.

The leaves of this plant are broader than either of the former;—the flowers of a pale purple colour, springing from the bottom of the leaves by pairs;—the pods are first yellow, but black when ripe, and roundish, almost like those of common peas.—They open very soon after they turn black, and shed the seeds,—which are freckled and flattened like the vetch, or small yellow lupine, but not so bright in colour.

I have been attentive to these plants of the pea-tribe, chiefly because it has been often remarked, that no other class of plants

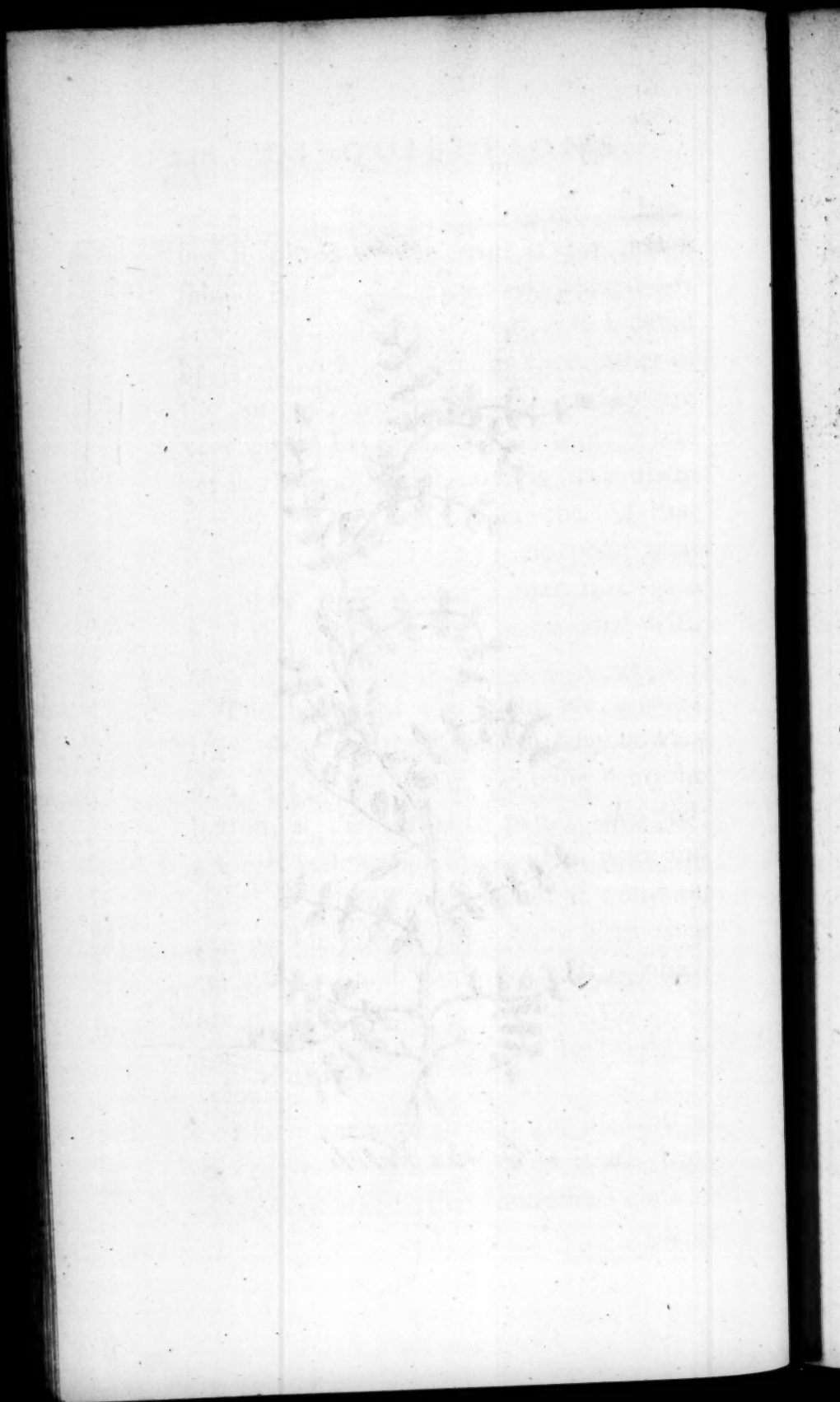
p 432

Tab 14



Bush Vetch

AB sc



plants afford such nourishing food for quadrupeds as this does; from which it is probable that they would yield hay of a more nourishing quality, than any that is produced from culmiferous plants. And as it is always for the profit of the farmer, to have as great a variety as possible of useful vegetables, that he can cultivate, that he may thus have it in his power to rear those only which are best adapted to his soil and other circumstances, it is imagined the few hints that have been given relating to these may be of some use; especially as there are no other plants commonly cultivated by the farmer, that are, like these, so strictly perennial, and which admit of being either cut or pastured for any number of years, that he may incline:—qualities that in some particular situations would render them highly valuable.

There are a great variety of plants of this class, that I have had no opportunity of observing, which might probably be possessed of other qualities, that might render them very beneficial to the farmer, and therefore, they demand the particular

attention of the improver. Among these, the common everlasting-pea, which is cultivated in our gardens, as a flowering-plant, would probably yield a prodigious weight of hay upon an acre;—as it grows to the height of ten or twelve feet, having very strong stalks, that could support itself without rotting, till it attained a very great height.—But I have never yet had an opportunity of trying it, or of knowing in what way it would admit of being cultivated.

Since the former editions of this Work were printed, another plant has attracted my notice, which promises to be a valuable acquisition to the farmer, the *Coronilla varia*. It is at present cultivated in gardens, only for the beauty of its flowers. It there recommended itself to my notice, for the closeness and luxuriance of its shoots, and the richness of the herbage it produces. Having cut it over frequently, I found that it pushed out fresh shoots with great luxuriance; and having found, upon trial, that it was eaten by horses and cattle, I determined to make
some

some experiments on the easiest way of propagating it.

This plant sends out strong shoots early in the spring, which are garnished with leaves, much resembling those of Tain-soin. Its flower is of the papilionaceous kind, which consist of a round tuft, resembling a head of clover, but larger; there being only one circle of flowers, each of which flowers, taken singly, is of a much larger size than a clover flower, and of a pale pink or bluish colour. The plant has no clasps, but it sends forth flowers at every joint, which successively come into blossom, from the month of May, till the end of the season. Its roots are fibrous and spread to a great distance, near the surface of the ground, from which it sends up abundance of shoots all around, so as to become very troublesome in a garden.

With a view to propagate this plant, I tried to gather its seeds, but I soon found that was a very hopeless task; for the pods, in general, fall off soon after the flower is gone, so that not one out of some hundreds ever bears a seed. I then tried to propagate it by its running roots, and

succeeded in this way to my wish. Having dug up a number of those roots, and divided them into pieces, leaving at least one good eye to each (but better three or four, as these roots can easily be got in abundance, after you have once obtained the plant) I planted these by a dibble, about one foot distant from each, in a small patch newly dug over, in the month of May, as might have been done in a field of new-sown barley. It was left in that state without farther trouble (unless to cut down the weeds, to prevent them from coming to seed) with a view to see if it could be made thus to fill the ground. Next season, the whole patch was completely stocked with plants, which by the beginning of May, afforded a full crop of luxuriant herbage, more than a foot high over the whole; which in appearance very much resembled a field of sainfoin, only that it was considerably closer in the pile. It was cut over during the season, three times, and afforded at each cutting a great load of very fine herbage.

Thus far does my experiment go, and no farther. It establishes the fact, that it may

may be very easily propagated, and that it grows luxuriantly. The only inconvenience I can perceive, from the rearing of this crop, would be this: It increases so very fast by the roots, that it probably would come, in a short time, to overstock the soil so much, as of necessity to dwarf the plants very much, and make its produce trifling. Should that happen to be the case, an obvious remedy occurs:—Whenever this malady was seen to come on, it would only be necessary to run a plough-furrow down the field, at the end of autumn, when the plant dies entirely down, and at the back of that another, and so on over the whole field; leaving it in ribs, or ridgelets, about two feet wide. In this state let it remain, till the month of April, and then harrow down these ridgelets, so as to smooth the field, gathering off the roots which are torn out, and either employing them as plants where wanted, or giving them to beasts, if they shall be found, upon trial, to be palatable and nourishing; otherwise, they may be thrown away, as useless. Notwithstanding the seeming boldness of

this process, there can be no doubt, but the whole field would be abundantly stocked with plants for the ensuing season, which, in consequence of this kind of hoeing, would grow with the greatest luxuriance. By repeating the same operation every year, there can be no doubt but the field might be continued to yield abundant crops of this kind of herbage, for many years.

“These hints are here offered merely as experimental trials, not as practical directions, which are the result of experience.—The qualities of the plant require to be more fully ascertained before the culture of it should be entered upon at large,—for I well know that experience often discovers defects which are not obvious upon a first trial.—But if, among a number of trials, one only succeeds, much good is gained by it to the community at large. At present, when great clover becomes so shy in many places, it is of great importance to try to obtain a substitute for it.—This is, at least, a probable one.—It is certain that it may be propagated, as above, fully as cheap as red clover ;

clover; and as it is a perennial plant, should it answer in other respects, much saving would be made in the article of propagation.

We have lately had another plant recommended to our notice, by the cultivators in France, from which great hopes have been entertained, the *Ghicorium Intybus*. It is a strong, robust, coarse looking plant—but from the few trials I made upon it, it did not seem quite to answer the hopes that were entertained from it. In one respect, indeed, it seems fully to answer expectations; for both cattle and horses seem to relish it almost above any other plant, so as to eat it very greedily. If it be cut and given to them, before its stalks have acquired a woody hardness, I have never seen one bit of it refused by them.

Several other plants have, of late, been recommended to the notice of the British Farmer, for cultivation, by well-informed cultivators, among which I have seen none that promises better than the *Medicago Lupulina*, an abiding plant, that grows with great luxuriance, and is relished by all cat-

tle.—But if others shall be as unsuccessful as I have been, in saving its seeds, it will be a matter of great difficulty, indeed, ever to get it propagated in abundance; for though I had near a dozen of healthy plants of it for three years, I could scarcely save the seeds from a dozen of pods, in a season.——To return to our pasture-grasses:

The narrow-leaved plantain, or rib-grass, is well liked by horses and cattle, and yields a very good crop, upon rich ground, tending to dampness, if it is at the same time soft and spongy; but upon any soil that has a tendency to bind, or upon dry ground, it furnishes but a very scanty crop. But as both this and white or Dutch clover have been long cultivated as pasture-grasses, it is less necessary for me to recommend them to the public notice: they are both good pasture-grasses.

The small grass-leaved plantain* deserves the attention of the farmer, as a valuable pasture-grass. Like the milk-

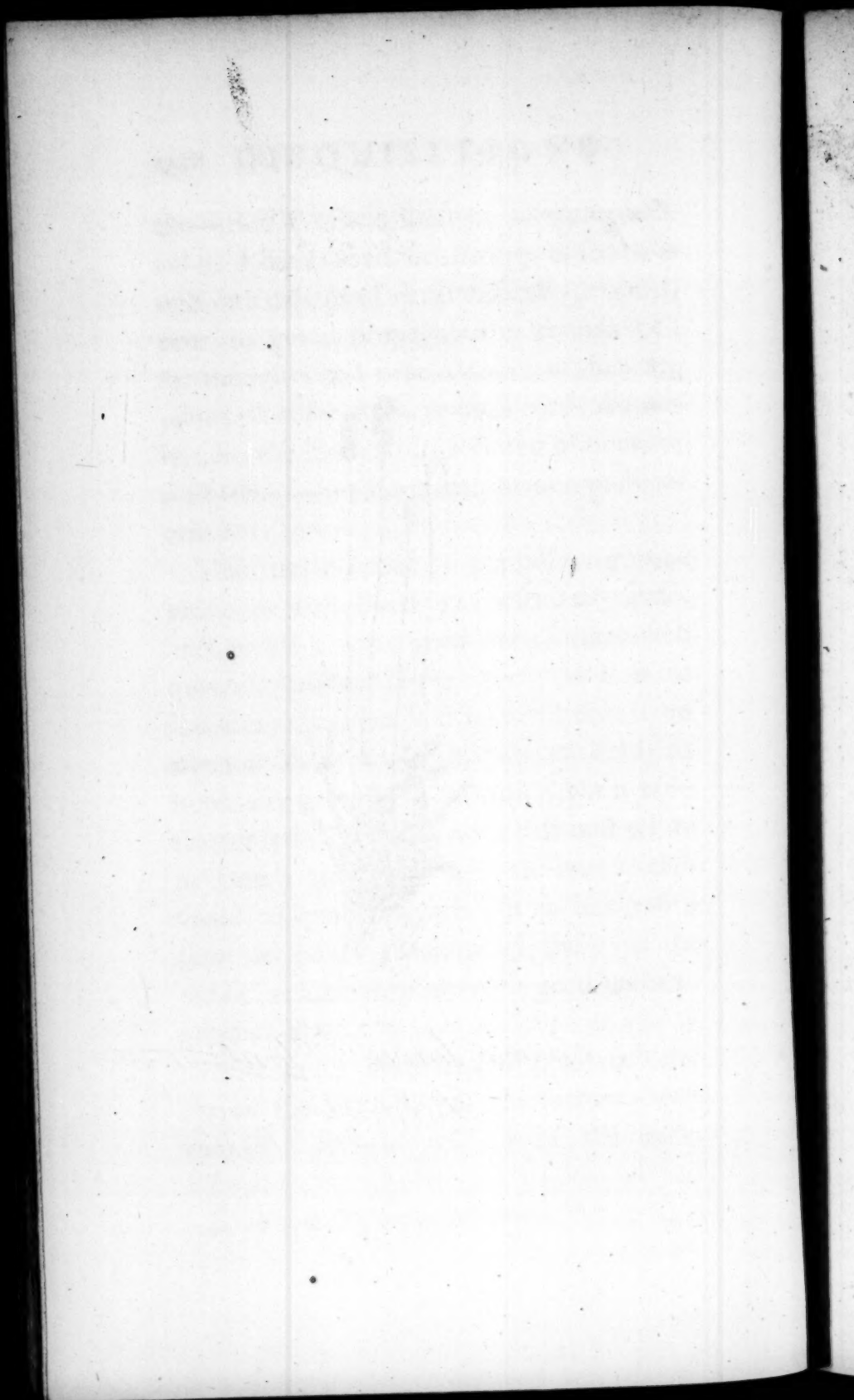
* *Plantago tenuifolia.*

p. 434

Tab. 15



*Narrow leaved Plantain or
Ryegrass*



wort, it will thrive upon barren soils, where hardly any other plant could live. It may be most easily distinguished on poor clays, where it is frequently found without the mixture of any other plant.—But it also abounds in many other pasture-fields, where the grassy-like appearance of its leaves prevents it from being remarked. I have seen some downs (links) upon the sea-shore, the soil of which consisted of a shelly sand, that were covered with this plant, almost entirely.

Its leaves are small, and have much the appearance of some of the thickest and most succulent kinds of grass.—Its flower-stalks are numerous,—about eight or nine inches long, and the spike of flowers and head usually about three or four inches long.—It produces abundance of seeds, which could be saved at little expence.

Cattle, horses, and sheep eat the leaves greedily; especially sheep, which bite it very close to the ground. On this account, the seed-stalks are seldom seen but on the top of sea-dikes, or on other corners to which no kind of cattle have

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access.—Even the stalks, while succulent, are cropped readily by cattle: But when they are hardened, and the seeds begin to ripen, they appear very coarse and disagreeable to look at.

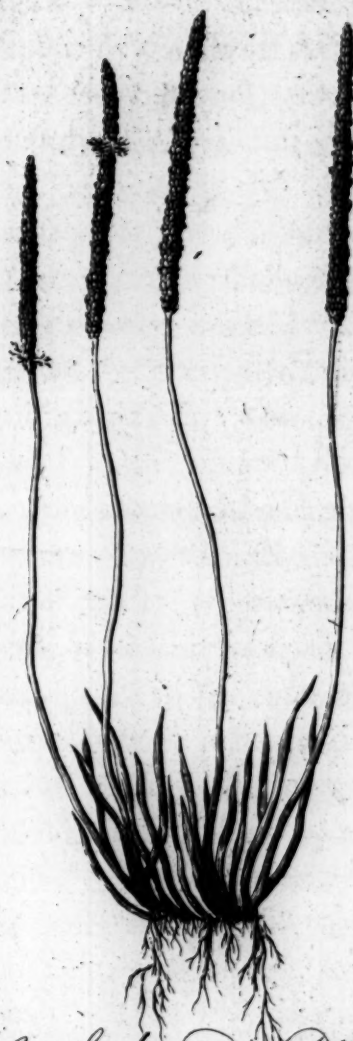
No plant bears the sea air better;—and it grows well where it is sometimes covered with salt-water.—It would, therefore, do well for salt-marshes.

I shall only mention one other plant that has come within the sphere of my observation, as deserving to be cultivated by the farmer, viz. the common yarrow*, *Achillea millefolium*, or hundred-leaved grass, as it is sometimes called.

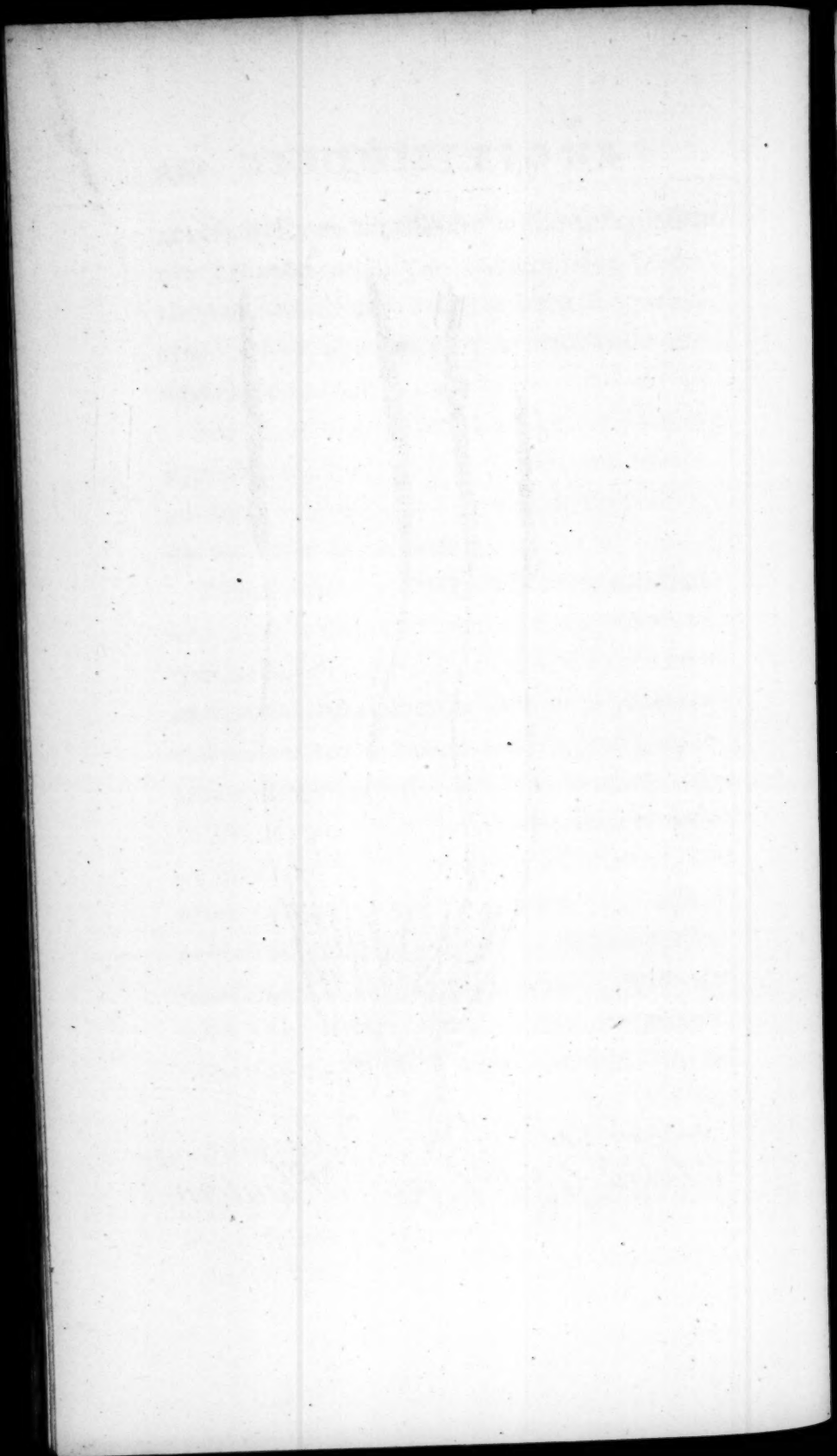
Those who may have formed an opinion of this plant, from what they have remarked of it by way sides, or other neglected corners where its flower-stalks have been allowed to advance, and its seeds to ripen, will probably be much surpris'd to hear it recommended as a

* The farmers in Scotland will please to take notice, that this is not the plant known among them by the name of Yarr, Spurrey (*Spergula*) but another plant, of very different qualities, as they will observe upon perusing the text,

Tab 16



Small Grass leaved Plantain



valuable pasture-grass, as they may very naturally imagine that no animal ever tastes it. For these flower-stalks are carefully avoided by every animal, while all the plants around them are eaten to the ground.

But this plant is not singular in having its leaves relished by many animals, and searched for with avidity, while its flower-stalks are rejected by them with disgust. For Nature, probably with a view to preserve the seeds of those plants from destruction, that were intended to clothe the fields with verdure, and furnish abundant food for all the classes of *graminivorous* * animals, hath rendered most of their seed-stalks disagreeable to the taste of animals in general :—hence it happens, that the seed-stalks of almost all the grasses, properly so called, are disliked by almost every quadruped, while their leaves are relished as the most grateful food that they can find † ; and therefore, those kinds of
grasses,

* Animals that feed upon plants.

† Ought not this to afford a presumption, that the hay which is made of the flower-stalks of *culmiferous* grasses,

grafs, that run chiefly to feed-stalks, are disliked as a pasture. It is probable, that the feed-stalks of every plant of this class, are equally disagreeable, and would be equally avoided by them, were it not for the small size of some of these, and the number of leaves with which they are enveloped; which, at the same time, prevents the animal from selecting them from the other parts of its food, and from feeling the disagreeable flavour that they would be possessed of, if they were eaten by themselves.

But if the plant of which we now treat, is allowed to remain untouched till its feed-stalks are formed, these become so large, and are so easily separated from all other plants, that every animal which feeds there can distinguish and avoid them with the greatest facility; so that while the leaves that spring out at the root are eaten down close to the ground, the stalks are allowed to remain untouched, till their

grasses, will not be so palatable or nourishing as that which is made from the leaves, or other parts of such plants as admit of this?

feeds

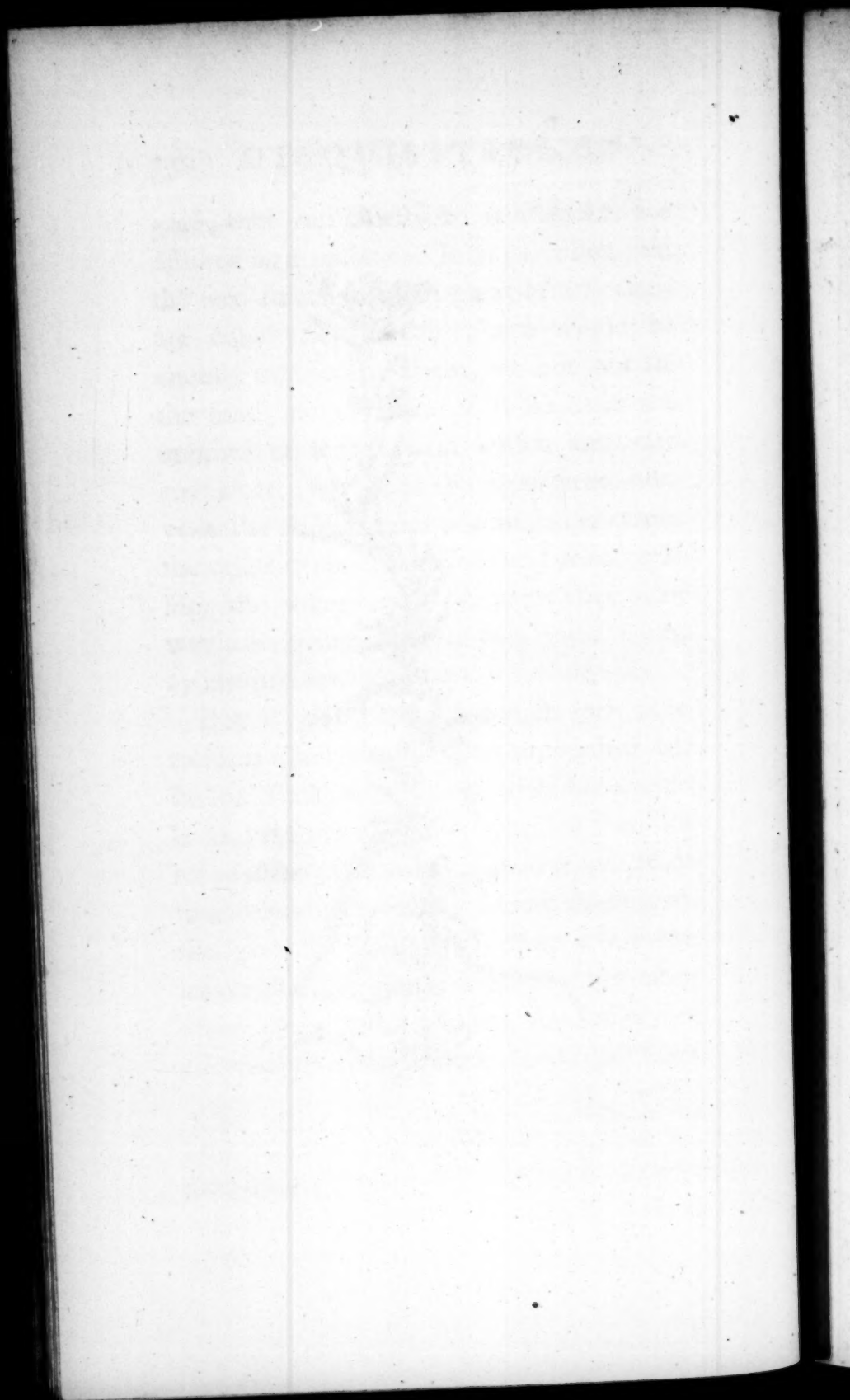
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Tab. 17.



Th. def.

Yarrow



seeds are perfected. And as, by their natural strength, they are able to resist the inclemencies of the weather, and remain standing long afterwards upon the same spot, when they assume a very disagreeable appearance, we have been induced, from these circumstances, to think but very meanly of the whole plant.

This prejudice is still farther augmented by another circumstance that rather ought, in the strongest manner, to demonstrate the real value and excellence of this plant. For, as we never see one seed-stalk of this grass, in our finest pasture-fields, we too hastily imagine that *it* in no case contributes to the goodness of them.—But the fact is directly the reverse of what it appears: For, upon a closer inspection, it will be found, that in almost every fine old pasture, a very great proportion of the growing vegetables with which it is covered, consists of this very despised plant;—but the animals who feed there, are so fond of it, as never to allow one stalk of it, in these situations, to come to feed; so that it there always consists of leaves, which are confounded with others
of

of which the pile consists, and constantly eaten along with them. This, therefore, forms one of the best grasses, in our finest pastures, and is more universally found in these, than, perhaps, any other plant whatever; which is probably occasioned by the extreme lightness of its chaffy seeds, which are easily carried by the wind to a great distance, and are thus more universally established than other grasses whose seeds are more weighty, and therefore less easily disseminated. As the seeds could be easily collected, and come up very readily when they are sowed, the farmer has it in his power thus to improve such pastures as he may incline, at a very moderate expence.

One of the most perceptible distinctions that takes place between old rich pastures, and such as are newer, seems to be, that, in the former case, the pile of grass is much closer than in the latter; which, in all probability, arises from a difference in the nature of the plants that abound in the one or the other. For if this were not the case, we might easily make our new pastures as close as any old ones could possibly

possibly be, by sowing a greater quantity of seed: But should we attempt thus to make the pile of a new-laid-down rye-grass-field, equally close with that of an old pasture, the plants would be so much stunted in their growth by this unusual degree of thickness, that we would lose our crop entirely. The only method, therefore, that remains to be followed by us, if we wish to make our artificial pastures to equal or exceed the finest natural ones, in this respect, will be, to distinguish with care, those plants that have a natural tendency to grow close upon one another, from those that require to have greater room to spread themselves; and to cultivate the former with care, when we have once discovered them. Thus, if the plants above enumerated, the sheep's-fescue, and creeping poa, or meadow-grass, naturally grow with their leaves much closer upon one another than rye-grass, or most of the others; and the purple bush-vetch has always perhaps ten times more plants springing up in the same space of ground than the blue-tare above-mentioned.— Now, it never fails that the yarrow a-
bounds.

bounds very much in the very closest parts of the closest pastures; and therefore it would seem, on this account, highly to merit the attention of the farmer, as it will give him an opportunity of making his new pasture-fields obtain a close pile much sooner than they would have done had they been left entirely to themselves.

—But this plant seems to be altogether unfit for hay, and, therefore, ought only to be sowed where the field is intended for pasturage, unless that hay shall be made after the manner recommended in the Third Essay of the Third Volume of this Work.

It seems to delight chiefly in dry soils, or, rather, in soils that are not wet:—For it arrives at its greatest perfection in rich fields that are naturally fitted to produce a rich and succulent crop of grass.—It grows also upon clays, if dry—and is among the first plants that strike root in any barren clay, that has been lately dug from a considerable depth; so that this plant, and thistles, are usually the first that appear on the banks of deep ditches, formed in a clayey soil.

But although it takes root upon clayey
soils

soils, and grows there more readily than most other plants, yet it delights more in a loose, spongy, porous soil,—a kind of soil in which fewer plants are found to prosper well, than almost any other. The soil that is peculiarly fit for clover, is by no means so favourable for this plant as that on which rye-grass thrives in perfection.—But it will grow and thrive in a still more spongy soil than rye-grass can do. My experiments, however, have not yet been so numerous as to enable me to speak farther here with the certainty I could wish.

All animals delight to eat it; but from the dry aromatic taste that it possesses, we would imagine that it would be peculiarly favourable to the constitution of sheep. They are very fond of it, and eat it to the ground, in all their pastures.

Before I leave this article, justice requires me to acknowledge, that I owed the first thought of the usefulness of this grass, to a hint with regard to it, thrown out by Dr. Hill, in some of his performances, which I found quoted in some book that I chanced to read.

There are, no doubt, many other plants that would greatly add to the value of our pastures, were their qualities and the mode of cultivating them duly pointed out. The *Melampyrum*, or cow-wheat, in particular, has been said greatly to add to the quality of the milk, and flavour of the butter of the cows which feed upon it. But of this I have as yet had no experience.

I hope that this small opening will encourage others to proceed in the same walk, and oblige the world with greater and more important discoveries.

XXXVI.

What is the most economical manner of consuming the produce of any pasture-field?—That is to say—Whether ought the animals who are to feed upon it, to be turned upon it at large, and be allowed there to remain, without any change of pasture, for the whole season?—or, ought they rather to be kept upon it only for a short time, and then carried to another?

—or,

—or, in what other way ought they to be treated, so as to turn out to the greatest profit of the possessor?



The practice that, in general, prevails throughout the greatest part of Britain, in rich inclosed pastures, where domestic animals are intended to be fattened for the butcher, is, to turn out the whole number of beasts that is supposed the field could properly maintain, into it, in the beginning of summer, where they are allowed to go at their own ease all the remaining part of the season, without any change of pasture at all.—And although many who have been accustomed to practise this method, are very positive in their assertions, that it is the most economical mode of consuming their pastures that could be practised, yet as I do not find they support this assertion with any decisive experiments, there seems to be so many reasons to make us doubt if the fact be as they assert, as should induce us at least to suspend our opinion till the necessary experiments shall be fairly made,

which shall ascertain this point with precision.

For, as the greatest part of the common grasses grow more quickly during the beginning of summer, than they do after the season is farther advanced, if we were to attempt to put nearly as many beasts into the field, as would be sufficient to eat up all the grass that advances at that period, they would not have half food during the remaining part of the season. To avoid this inconvenience, therefore, it becomes necessary to put only as many beasts at that time into the field, as can be afterwards maintained in it properly, so that many plants must then be suffered to run to seed; after which, no animal will taste them, unless constrained by hunger.—Many plants, also, are, at this period, trodden down by the feet of the beasts, in their wanton gambols, which are never afterwards much relished by them.—And as it has been already demonstrated, p. 30, Vol. II, that many plants soon attain to a certain length, beyond which they never advance, if not eaten down or cropped; the
whole

whole vegetation of the field must thus be stopped, and the total produce of it throughout the whole season be greatly diminished, when compared with what it might perhaps have been by a more skilful management. And,

If, with a view to remedy, in some measure, this inconvenience, a greater number of beasts should be put into the field during the beginning of summer, than towards the end of it, we would indeed, in some measure, diminish the evil, but not effect a radical cure.—For if the field were at that season eaten so bare as to prevent any of the plants from running to seed, there would be some room to dread that the animals would be too much stinted, for food to fatten kindly.—And as the grass upon which they have lately breathed is, in general, disagreeable to them, it is much to be doubted if they would come so quickly into flesh, as would abundantly reward the hopes of the husbandman*.

From

* For these reasons, experienced graziers, in general, find it their interest to keep their pasture-fields very

From these considerations, it would seem probable, that there must always be a considerable waste of food, by this mode of management, let the farmer be as attentive as possible; which, it is imagined, might, in a great measure, be prevented by the following, or some similar practice:

As every kind of animal delights most to feed upon fresh plants, that have newly sprung up from a bare surface, in which there is no decayed or rotted stalks of any kind; there can be little doubt, but that if cattle which are intended to be fatted, were always supplied with a constant succession of this kind of food, they would be brought forward in flesh as quickly as the nature of that food could in any case do it.

To obtain this constant supply of fresh grass, let us suppose that a farmer who has a large extent of pasture-ground, should have it divided into fifteen or twenty divisions, nearly of equal value; and that instead of allowing his beasts to

lightly stocked with cattle; it being a smaller evil to lose a considerable proportion of their grass, than to have their cattle in any degree stinted in their food,

roam

roam indiscriminately through the whole at once, he should collect the whole number of beasts that he intends to *feed*, into one flock, and turn them all at once, into one of these divisions: In this case, the grass being quite fresh, and of a sufficient length for a full bite, it would please their palate so much, as to induce them to eat of it greedily, and fill their bellies before they thought of roaming about, and thus destroying it with their feet. And if the number of beasts were so great as to consume the best part of the grass of one of these inclosures in one day, they might be allowed to remain there no longer;—giving them a fresh inclosure every morning, so as that the same delicious repast might be again repeated. And if there were just so many inclosures, as there required days to make the grass of these fields advance to a proper length after being eaten bare down, the first field would be ready to receive them, by the time they had gone over all the others; so that they might be thus carried round in a constant rotation.

But as it would be necessary to allow

his *fattening* beasts always to have a full bite, it would not be proper to keep so many of these as would at any time eat one of these fields quite bare in a day.— And as the grafs that they would thus leave behind them, would, if left in that state, in part run to feed before they could return to the field, while some other parts of it would be withered or half-rotted, the pastures would be thus rendered less sweet and nourishing, than they would otherwise have been:—And as there would likewise be a smaller quantity of grafs produced on the field in this way, than if it had been eaten quite bare to the ground, it would be great want of economy in the farmer, not to keep another set of young or lean beasts, which should regularly succeed the first, and eat up all that they had left, so as to make it quite bare, and put it in a proper condition for vegetating again with vigour. And as it would be always in his power to augment or diminish this last stock, as circumstances might require, by keeping a few supernumeraries in some spare field, or by buying in others, it would seem that

he

he would thus have a probability of reaping the full benefit of every blade of grass that could be reared upon the field;—more especially if the circumstances mentioned in the following Disquisition, were duly attended to.

There is no doubt, however, that cattle, when allowed to roam at large on an extensive field, will fatten very kindly, if they have a sufficient quantity of food: But the question at present is, Whether the same field will feed, to perfection, a greater number of beasts in the one or the other mode of managing it? The subject is of importance, and deserves to be elucidated by *proper* decisive experiments. See this subject farther elucidated, Vol. III, Essay Third.

XXXVII.

Can the produce of a farm be, in general, consumed with as much profit by only one species of domestic animals, as by a greater variety of these?—If the last shall be the case, which of the animals commonly propagated by the farmer in this country

country could be most economically reared upon the same farm with others?—And, in that case, what would be the most proper method of feeding them?—That is to say—Whether ought they to be allowed to pasture on the same field at one time, or to succeed one another upon it?—If so, In what order ought they to follow one another?



As it is certain that one class of animals, on many occasions, delights to feed upon plants which are totally disregarded by, or which are even noxious to others, it would seem, that unless a man had his farm in such order as that no one plant would grow upon it which he did not cultivate, it might so happen, that among the variety of plants which spontaneously spring upon it, there would be some that would be improper for any one class of animals;—all of which plants would be totally lost, if he should confine himself to that single species of animal only. But as few farms are in the order here supposed, it seems highly probable, that it would be always an advantage
for

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for the farmer to keep more classes of animals than one upon his farm : And considering it merely in this view, the greater variety he could keep, the less waste he would sustain. But other economical considerations may frequently make it proper for him to submit to this loss, instead of perhaps a greater, that he might sustain by too closely guarding against it,

The rural economist reaps another advantage by allowing different classes of animals to pasture the same field : For, even supposing that the whole of the plants produced upon it should be wholesome and agreeable to one class, yet as no animal will eat the grass that springs up where one of its own species has dunged till it has got a winter's frost, although the grass produced by this means is greedily eaten by another class of animals,—if no more than one species is ever admitted into any field, the waste which is sustained by that means must be very considerable ; which would have been totally saved by a more prudent management.

On another account, likewise, we would expect that the farmer would derive some advantage

advantage by keeping different classes of animals rather than one species : For, as some of these naturally prefer the flowers and stalks of plants, which others reject, and only eat the leaves ; while other kinds are still more fond of the roots ;— and as some kinds bite much closer to the ground than others do ; it would seem, that by having different classes upon the same field, much would be saved that must otherwise have been lost.

The Dutch, who are in all cases attentive to economy, have long perceived the benefit that may be reaped from a due attention to this circumstance, and have turned it to their advantage ; so that it has become a common observation among them, that when eight cows have been in a pasture-field, and can no longer get any nourishment from it, two horses will usually subsist in it very well for some days ; and when nothing is left for the horses, four sheep will live comfortably upon it for some time longer. In which case, it is plain, that if nothing but cows had been kept upon the pasture, all that was consumed by the horses and sheep would have been lost.

I imagine

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I imagine, that all kinds of animals usually feed most quietly when they are not mixed with others; and therefore it is probable, it would be usually the most advisable to keep the different classes separate, as in the Dutch experiment: but whether the order they prescribe is the best or not, I cannot pretend to say. As goats love the flowers and stalks, it is probable that they should be first put into the field. These might be followed by cattle who love to get a full bite, and cannot eat close to the ground. Horses, as delighting in shorter pasture, would probably succeed them with advantage; and sheep, that delight in the crowns of roots, and that part of the grass which grows nearest the ground, ought, in all cases, to come last. Probably, hogs and some other animals might be wanted to eat up the whole of the plants, without the smallest waste.

By making different classes of animals thus succeed each other, in due proportions, in the different fields, as mentioned in the last Disquisition, it seems probable, that every plant might be eaten close to the ground, without starving any of the beasts
that

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that are fed upon the field; and thus the vegetation be kept up perpetually fresh and vigorous, without the smallest waste. We are thus also enabled to observe the great utility that would result from carrying on the business of a grazier upon a very extensive scale, as it is only in these circumstances that the just proportion of the different classes of animals could be kept for effectually answering the purpose required. See this subject farther elucidated in the 3d Essay, Vol. III, of this Work.

XXXVIII.

Are there not many useful domestic animals known in different parts of the globe, that might be economically reared in this country, and tend much to promote the progress of useful arts, if they were introduced?—If this be so, what are the animals that promise to be of the greatest utility, and the particular purposes that each of them might be supposed most effectually to serve?



For the reasons alleged in the foregoing Disquisition, it is plain, that the greater

the variety of useful animals is among which the farmer may be at liberty to choose, the greater chance he will have to get every product of his farm consumed to the utmost advantage. For, as different classes of animals require food of different kinds, he will thus have a chance of getting every useless vegetable consumed with profit.

Hitherto, the attention of the farmer has almost never extended farther than to the five domestic animals so often mentioned in this Essay—horses, cattle, sheep, goats, and hogs; so that even some animals that are natives of this island have been totally neglected, or considered in some measure as wild, and therefore beyond the sphere of the farmer's attention. Of this sort is the rabbit; which, it is possible, might, on many occasions, be kept as a tame animal with great profit, as it eats almost every green thing, and could probably be nourished upon plants that are rejected by all our other domestic animals: and its fur, if the rabbit be of the best sort, is of such value, as always to be sure of coming to a ready market.

But, not to dwell on what may by many
be

be deemed such an unimportant object, we may observe, that there seems to be no reason in the nature of things to make us suspect, that the goat of Angora, which furnishes the fine Mo-hair that constitutes such a considerable branch of our Levant-trade, might not thrive in Britain as well as in its native country. For, although we do get this wool from ports that are situated in a warm climate, yet the animal itself lives upon the rocky mountains of Pontus, where it experiences a very considerable degree of cold: And it might probably be bettered, rather than rendered worse, by being introduced into Britain.

The same argument might be adduced, to show that the goat of Thibet, known by the name of Touz, that carries the still finer fleece, which is valued at three times the price of the famous Persian wool, might be here reared with profit, as the country that it inhabits is undoubtedly much colder in winter than any part of Britain.—Neither is there any certainty that the goat of Golconda, which yields the Bezoar as well as a very fine wool, might not admit of being kept with profit in Britain, as it has never

yet, that I have heard of, been fairly tried. But there can be no doubt but that the Chamois goat of the Alps would thrive well on the high mountains of Wales and Scotland, where hardly any other animal at present feeds: And the Bouquetin of the same country, which delights to live chiefly among the ice upon the tops of the highest Alps, and is in many respects an useful animal, would consume those plants that grow where none of our own animals at present dare venture.

The sheep of Persia and Spain are known to produce wool of a much finer quality than that which is yielded by sheep in any other part of the globe; which we have hitherto been inclined rather to attribute to the influence of their particular climate and pasture, than to any essential difference in the original breed of that animal reared in these countries: And therefore we have been disposed to look upon every attempt that may have been made to introduce that breed of sheep into our own country, as wild and chimerical; so as to sit down contented with our own situation, and allow the inhabitants of these countries to enjoy the

benefits of their good fortune without molestation.—Yet the Author hereof flatters himself with the hope, that if the Reader has attended to several observations that have occurred in different parts of this Essay, he will be led to think, that there does not appear any reason against it, so strong as to debar us from all hopes of seeing such an attempt, if wisely conducted, attended with success.

The Lama, Guanacoe, and Paco, of America, are varieties of a class of animals of the camel-tribe, which subsist upon little food, and probably delight to eat such plants as are either useless, or noxious to all our domestic animals. Some of these have so much bodily strength as to be employed by the natives of Peru as beasts of burden; and they all afford a kind of wool of a peculiar quality, that might be employed with success in many of our manufactures, and help to give them such peculiarities as might entitle them to a preference to those of other nations in foreign markets, were we so wise as to adopt them. And although they be natives of a tropical region, it has been already
shown

shown that there is reason to think they might be able to endure the cold of our climate, without any apprehension of their being hurt by it; seeing they constantly choose to frequent the snowy mountains that abound in their native country*.

Neither are we as yet sufficiently acquainted with the nature and distinguishing qualities of the Urus, Bison, and Buffaloe—varieties of the cattle (*Bos*) tribe. In Italy, and other warm countries, the Buffaloe is employed as a beast of burden, and is supposed to be equal in strength to three or four horses. They yield a considerable quantity of milk, of which good cheeses are made; and although their flesh is not so much valued as our beef, yet the hide is deemed, in many respects, preferable to that of our ordinary cattle. In Hindostan, and other parts of the East-Indies, they have another variety of these, that are still

* Some attempts have been made to introduce these animals into Spain, but without success.—Buffon justly observes, that these trials have probably proved abortive, by the animals having been confined to the warm plains of Andalusia—a climate by far too hot for them to live in. Probably, they would have thriven upon the Alps, if allowed there to range at large.

more tractable than either the Buffaloe in Italy, or the ox in other parts of Europe, which are therefore employed as almost the only beast of burden in all these countries.

—The Bison is reckoned still more docile and tractable than these, and is employed in some countries for the purposes of war; and, what is more surprising still, as a guard and attendant of their flocks, in the same manner as our dogs. The Urus is a native of temperate climates, and, although of an enormous size, is gentle, and easily tamed; but, it is utterly unknown in Britain *. In Louisiana, there is a variety of this class of animals that is covered with a very fine and close fur, that more resembles wool than hair, which is employed by the natives for the same uses as wool. These animals are there wild, but might easily be tamed. But whether that fleece would admit of being annually shorn like that of sheep, or what would be its particular value in manufac-

* Some horns that seem to have belonged to the Urus, have been lately found in Scotland, which seems to prove that it had been once a native of this island. These horns may be now seen in the Musæum of the Scottish Antiquaries, in Edinburgh.

tures,—or, whether the animal would be possessed of any other valuable qualities, we are as yet a loss to know. Its flesh is esteemed by those who have eaten of it;—and its skin, dressed with the wool, forms such a warm and useful covering for the Indians and Canadians, that they have hitherto kept them entirely for their own use; none of them, that I have heard of, having been hitherto exported.

In North America, they have likewise a species of deer, called by the natives *Original* or *Aurignial*, which seems to be possessed of some qualities that might perhaps, by the industry of man, be employed for his advantage. It considerably exceeds in height the tallest horse;—hath legs very long in proportion to its body;—runs with great swiftness; and, like all that class of animals, is endowed with very great muscular strength, and may be easily tamed, so as to become as gentle as a lamb. This account I had from a gentleman, who had frequently seen one of them in the possession of Gen. Carleton, when Governor of Canada, that was tethered every day upon its pasture like a cow, and was equally

tame.—This is probably the same animal that has been distinguished in English, by the name of Moose-deer, of the existence of which, so many have doubted.—In its wild state, it lives, in winter, chiefly upon moss and branches of trees, in this respect, resembling the Rhen-deer of Lapland. But, whether it could be brought at that time to feed upon any of the kinds of moss that so often cover our pastures,—or, whether the Rhen-deer is really incapable of being kept in any climate more temperate than Lapland, which has been often asserted with a great degree of confidence *;

—or,

* However positively this may have been frequently asserted, there seems to be much room to doubt if the fact be really so, as there is found in all the provinces of North America, even as far south as the Back Settlements of Virginia, an animal of the deer-kind, called by the natives *Caribou*, which is acknowledged to be, in all respects, the same with the Lapland Rhen-deer. And what reason have we to imagine, that an animal which can bear the intense summer-heats of Lapland, would not live in a more temperate climate, where those kinds of moss on which it chiefly delights to feed, can be found?

Of all the animals that roam through the woods of North America, none are more wild than the *Caribou* :

nor

—or, whether any other variety of this class of animals, or any other creature that could be useful to man, could be fed on any of those sorts of moss that so much abound in all our old pastures, and are entirely useless for every economical purpose that we know of—is not at all ascertained, although it is a subject highly deserving the attention of the Public.

Many other animals have been slightly mentioned by historians as possessing particular valuable qualities, but with so little accuracy, as not to admit of our relying on their accounts as certain.—Of this class is the *Anta* of Peru, an animal of the

nor have the natives ever once thought that it would be possible to tame it, or render it serviceable to man as a domestic animal, although the experience of the poor Laplanders sufficiently shows, that it may be rendered tame and gentle, and furnish alone almost all the necessities of life, to a frugal and abstemious people. From which example, we ought to be taught never to despair of being able to domesticate almost any graminivorous animal, however wild, if it can be of any essential service to ourselves.

N.B. Since the former Editions of this Work, the Rhen-deer has actually been imported into Britain, and has been found to live, and propagate, in Yorkshire, as well as in Lapland. *Note to the fourth Edition.*

Buffaloe-tribe, but of an uncommon kind, particularly esteemed there for the remarkable strength and thickness of its skin. The *Taparissou*, an animal of Brazil, said, in some respects, to resemble an ox and an ass,—remarkable likewise for the extraordinary strength of its skin. Others assert, that in Brazil they rear a kind of animal, resembling a sheep, as large as a horse, with long horns, and a short tail &c. &c.—But whether such animals as these do really exist or not, is very uncertain; and if they do, it is as doubtful if they could be of any use to us. But surely such objects deserve the attention of philosophical enquirers. The existence of the animal called *Nil-Gbau*, so lately seen in Britain, and so well described by Dr. Hunter, was deemed at least as great an uncertainty as any of these*.

XXXIX.

* Several attempts have been made in Britain, to obtain collections of *plants* from all parts of the world. It is to be regretted that no public institution has ever been made for collecting and preserving useful animals from different parts of the globe.—Here opens a fine field for conferring immortal honour on the man who first shall begin so great and useful a work.

N.B.

XXXIX.

We in Great Britain are as yet so little acquainted with the nature of the mule, and, at the same time, have so many imperfect accounts of the amazing strength and hardiness of that singular animal, as makes it much to be desired that an authentic account of it could be procured for the benefit of the farmer, so that he might know how far it might be prudent in him to make use of this in preference to every other beast of burden?

N.B. Since the former editions of this Work were published, the author presented a memorial to Sir John Sinclair, pointing out the great benefits that might be derived from establishing a society for the improvement of British wool, earnestly recommending it as an object worthy of his attention. He adopted the idea, and under his patronage has been since instituted the Society for the Improvement of British Wool; which, although it has not been productive of *all* the good that might have been derived from it, has still been of *some* benefit to the country, by giving room for ascertaining a few facts, which might long have remained doubtful. See farther on this subject, the following Essay in the present Volume; also, an Account of the Russian Sheep, &c. by Dr. Pallas, published by Chapman, Fleet-street, London.

This



This animal is said to be possessed of much greater strength, in proportion to its size, than either the horse or the ass; —is longer-lived than either of them, and can be supported on much poorer fare; —is hurt by no sort of bad treatment; —patient under hardships, with a long *et-cetera* of qualities, that those who are unacquainted with it, have difficulty to bring themselves to admit of, and yet know not how to reject the evidence with which they are supported, being sometimes so very strong.

If all these extraordinary advantages result from this kind of unnatural crossing the breeds of animals, one would imagine, that those who have experienced it in this instance, would have endeavoured to try what would have been the result of a similar crossing with regard to other animals that nearly resemble one another; —such as the cow with the urus, bison, or buffalo—the deer with the cow or goat, &c. &c.—But I have met with no account of any uncommon species of animal

animal of the mule kind, excepting one, that carries in its face so much the appearance of a fable, that I shall give the account of it in the very words of the author who relates it, Jean St. Leger, in his account of Switzerland:—‘ Among* the domestic animals,’ says he, ‘ there is only the *Jumarre*, that is altogether unknown in the northern countries. This animal is procreated either between a bull and a mare, or between a bull and a she-ass. The first are the largest, and are called *baf*; the latter are smaller, and are called *bif*.—

———— They have the head and the tail of an ox, with a small excrescence in place of the horns; the rest of the body resembles that of the horse or ass. Their strength is inconceivable in proportion to their size. They are smaller than mules, eat little, and are surprisingly expeditious on a journey (*dévorent le chemin*). I have travelled eighteen leagues, altoge-

* *Entre les domestiques, il n’y a que les jumarres, &c. Hist. Génér. des Eglises Vaudoises, par Jean St. Leger, pasteur. F. p. 8.*

‘ther on a mountainous road, on the 30th
 ‘of September, on a jumarre, but with a
 ‘good deal more ease than I could have
 ‘done it on horse-back.’

To deny a fact so positively asserted by a man of character, unless we had direct proofs of the contrary, would be rather bold. At the same time, I must acknowledge, that the difference of the mode of copulating is so great between cattle and horses or asses, that it is hardly possible to avoid reading this account with some degree of scepticism. Mention is made of this same jumarre, which is called *gimarro* in Italy, by other authors. But as many of our nobility and gentry have occasion to pass through Switzerland in their way to Italy, it would be easy for them, if they chose it, to get satisfaction as to this fact, upon the spot*.

N.B. Since the third edition of this Work, the following remarks relative to this

* Since the former edition of this Work, I have been assured by one who was in Switzerland for some months, that the *jumarre* is still there employed as a beast of burthen, so that there can be no reason to doubt the fact. *Note to the Third Edition.*

subject has fallen in my way ; it is extracted from Mr. Baird's Account of Middlesex, drawn up for the consideration of the Board of Agriculture, when speaking of the improvements that had been made by the late ingenious Mr. John Hunter, at Earl's court, in the parish of Kenfington, he says, page 42 :

“ This gentleman has, at present, a very beautiful little cow from a buffaloe and an Alderney cow. This animal is, in some measure, kept for her beauty; and, what adds to it, *she is always plump and fat, whether in summer or winter, and upon much less food than would be sufficient to support a beast of the same size, of the ordinary breed.* I do not find that she exceeds in quantity of milk, but the *quality* is very good, and it is certain, *she can be fattened at a much less expence than an ordinary cow of the same size.*”

This is a very curious fact, that deserves to be particularly adverted to ; should it prove to be a general rule, and not a particular exception, it would lead to very important consequences.

XL†.

Some plants grow only on a hard firm soil, and others thrive only in an open spongy mould.—Required, a list of each of these two opposite classes of plants, as also a specification of such plants as *approach* to either of these extremes?

It has been often disputed by practical farmers, whether rolling ground was an advantageous practice, or the reverse?—Probably, this may, in some cases, depend on the nature of the soil—and in others it may be influenced by the peculiar economy of the plants that grow upon it.

The broad-leaved plantain* requires a soil of such an unusual degree of compactness, as seems hardly to be ever met with naturally;—on which account, this plant is scarcely ever seen but upon road-sides, or other places where the ground has been

† This article, and the two following, ought to have been inserted after VIII, p. 49, but they were accidentally omitted in that place.

* *Plantago major*.

artificially

artificially compressed by some weighty body passing frequently along its surface*: hence it has obtained the vulgar name of the *way-faring* (corruptly *wavering*) leaf. If this were an useful plant, it could not be propagated without the help of frequent rolling.

The common knot-grass † possesses the same quality, in some measure, although not in such an eminent degree as the former, as it is most frequently found in places that have been much trod upon, and afterwards allowed to be undisturbed for some time; but it is also sometimes met with in other places.

The same may be said of the annual meadow-grass ‡, which is the last plant

* I have been assured by a respectable person, that this plant is often met with in the common fields in some parts of the county of Durham. If so, the soil must be very uncommon, and deserves to be accurately described. I never found it in the common fields in any place where I have been.

Since writing the above, I have seen in some fields the *Plantago media*, which I suppose has been mistaken by the gentleman above-mentioned for the *Plantago major*.

† *Polygonum aviculare*. ‡ *Poa annua*.

that

that disappears on the road-sides, except the two above named; but it is also found in situations where the ground is not nearly so much compressed.

Many other plants that grow naturally upon such soils as have an unusual degree of firm compactness, can only be made to grow on more spongy fields by frequent rolling or pressure of some sort, which gives them artificially that firmness of texture they had not naturally.

Perennial red clover * is a plant of this sort. It prospers abundantly in firm, and what might almost be called, obdurate clayey soils; but, in others of a looser texture, it is to be found only in the foot-paths that may accidentally be made through the fields. I have seen a foot-path of this sort strewed with this plant for many thousand yards in length, while not a single stalk of it could be found in the fields on either side.

The common white, or Dutch clover †, delights also in a firm soil, although it does not require such a degree of compactness

* *Trifolium pratense.*

† *Trifolium repens.*

as the former, and therefore prospers in many fields without any artificial pressure; but, on very spongy soils, Art must supply the deficiency of Nature, or it will not thrive.—Hence it happens, that, on soils of this sort, white clover is frequently seen to flourish exceedingly on such foot-paths as are moderately trod upon, while it only languishes, or hardly appears in other parts of the field.

On the contrary, the small-leaved sorrel * requires a soil of an exceedingly open and spongy texture, upon which alone it can be made to grow,—and is totally destroyed by any kind of weighty continued pressure upon it; of which I had once an opportunity of being fully satisfied, by an experiment that deserves to be recorded.

I had occasion to lay down a small spot of ground of this open spongy sort, into grass, by way of lawn. It was sowed with white clover seeds;—but in some of the spongiest, or, as the practical farmer would call it, *deafest* places, this small-leaved sorrel came up in such abundance

* *Rumex acetosella*.

as to choak the clover, so that hardly a single plant of it could be seen.

Vexed at this disappointment, I was extremely anxious to get this useless and unsightly plant eradicated:—But being at that time little acquainted with the nature of it myself, having come from a part of the country where it was hardly known,—I enquired of those who had been accustomed with it from their infancy, how it might best be destroyed—but in vain.

A very little attention, however, made me soon observe, that this plant was never found but on soils that were exceedingly spongy and open; and therefore it seemed probable, that if these soils were rendered firm by pressure, it might be thus destroyed.

And as rolling seemed to be the easiest method of effecting this, I resolved to try if it could be killed by this means.

With this view, a weighty stone-roller was brought to that part of the green where the sorrel abounded most, which was drawn along it for twenty or thirty yards, and pushed back again to its former

mer place regularly every morning,—keeping always exactly in the same tract.

In a few weeks the sorrel there totally disappeared; and the little alley formed by the roller in its course became covered with a close pile of white clover; although the ground on each side of it still abounded with the sorrel, and hardly a stalk of clover appeared among it.

Old pasture-fields, in our northern climate, are frequently over-run with fog, consisting of various kinds of mosses, which prosper abundantly during the winter-season. I never yet observed any fog in the foot-paths through the fields that were most infested with it; which would seem to point out, that frequent pressure might be an effectual means of eradicating it. Every circumstance that I have yet observed relating to the growth of this species of plants, seems to indicate that they prosper best on a spongy open soil. Moisture and cold seem also to be favourable to them. They seem to grow even in winter more luxuriantly than in summer.

Spurrey*—or, as it is sometimes called, Yarr,—is only found in the same sort of spungy soils.—It is an annual plant, that is exceedingly pernicious to the crops of corn in those countries where this kind of ground abounds. In firmer soils, the charlock †, and wild mustard ‡, become the scourge of slovenly farmers in its stead.

When this spungy deaf soil is in a different state of cultivation, it naturally produces the common dead (vulgo *dea*) nettle §. This especially abounds where a soil of this sort is trenched up, and the mould that has been long buried deep is exposed to the air.

The cock-tail, or feather-grass ¶, also requires an open and spungy mould, and cannot be made to thrive in any other.—Hence it happens, that in countries where this soil abounds, all the *manured* fields become naturally covered with this kind of grass, when they are left to themselves: For, as the seeds are light, they are carried

* *Spergula.*

† *Sinapis arvensis.*

‡ *Holcus lanatus.*

† *Rhaphanus raphanistrum.*

§ *Lamium.*

by the wind to a great distance, so that there is never want of seeds in abundance to stock all the fields; and where this grass prospers, it roots out all other sorts.

Rye-grass* will indeed make a struggle with it. And when the ground is properly cleaned, and a little consolidated by a good mode of culture,—if rye-grass seeds are then sowed in abundance, it will usually get the better of the former.

This species of grass (rye-grass) which is now so universally cultivated in most parts of Scotland, requires a deep, open, loose, deasish soil, tending to dampness, to bring it to full perfection. Wherever the feather-grass naturally abounds, skilful culture with lime will make the rye-grass flourish exceedingly. Nor do those who have not seen a soil of the nature here treated of, know to what an amazing degree of luxuriance this plant may be reared. I know well that people who live in countries enjoying a much better soil in general than that which has been familiar to me for some time past, would be little disposed to

* *Lolium perenne*.

give credit, should I assure them that, on a soil of this sort, [I have measured several stalks of rye-grass above six feet in length. —Yet this is a truth that could be attested by several respectable persons who saw and measured these stalks, should it be thought worth enquiring into*.

I forbear to mention the weight of hay I have cut from an acre of this sort of ground at one cutting, as I am sensible it would appear incredible.

Yet, on this soil, no culture that I have ever seen tried, can produce an abundant crop of red clover; which requires a weightier, firmer, or sharper soil.

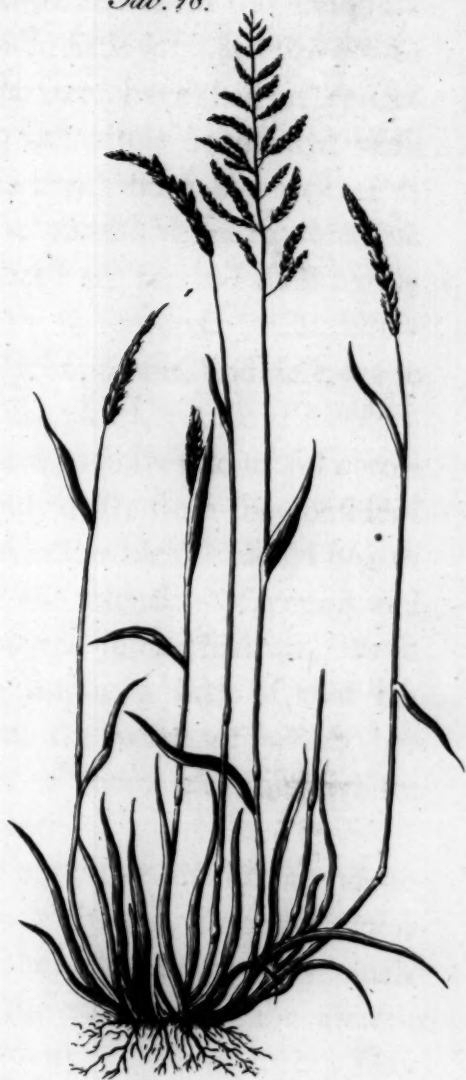
The cock-tail, or feather-grass, as has been said, only appears in fields that have been *manured*.—In other fields, consisting of the same kind of soil, the small bent-grass † as naturally and universally establishes itself.

* It is necessary to remark, that no kind of culture could bring rye-grass to this amazing length, unless the season was remarkably dry; for when the soil is rich, and the season damp, such a luxuriant crop would be rotted long before it could have attained any thing like maturity.

† *Agrostis capillaris*.

The

Tab. 18.



Cocktail or Feather Grass



The subject treated of in this Disquisition has been so little attended to, and so few practical farmers have had an opportunity of being intimately acquainted with soils differing so much from one another as those that have furnished matter for these observations, that I am afraid I shall hardly here be perfectly understood. It is, however, extremely important, and deserves to be farther elucidated.

Allow me here to draw one useful corollary that naturally arises from the consideration of this subject, which I would beg to recommend to the attention of young and sanguine improvers in agriculture, as it might tend to inspire a little of that rational diffidence, the want of which has proved the ruin of thousands who have set out in that career.

If large and extensive districts are to be found,—in which the soil, through almost every part of the one, differs very much from that in the other as to the above-mentioned particulars, although they may perhaps agree very much in their general appearance, and the proportion of sand and clay, and the other distinguishing particu-

lars of soils usually taken notice of by writers on agriculture, or others, it must follow, that the man who is the best acquainted with the best mode of culture for the one of these countries, may be altogether unacquainted with the best method of treating a field, that he might think was very much of the same nature with his own in another district.

Hence it follows, that the travelling farmer ought to be cautious how he condemns some particular practices he may observe, that may to him appear extremely unreasonable,—as circumstances may sometimes render one practice very proper, which, upon a soil of another sort, would be attended with the most baneful consequences.

Hence, likewise, it follows, that the young improver ought to be extremely cautious how he adopts the advice of such farmers as may have been bred on a district at a great distance from his own, as he may ruin himself by pursuing a practice in the one case, that might be highly advantageous in the other. The hints of the sensible men in his neighbourhood ought to listen-

ed to with attention; but an observing eye, and an unremitting attention to such facts as may occur to one's self, are the only sure guides. Till experience has accumulated wisdom, safety consists in cautious circumspection alone.

If I speak here with a more than ordinary degree of solicitude, it arises entirely from a full conviction of the mischievous consequences that often result from an opposite conduct, and a warm desire to avert from others such calamities as I have, in many instances, seen arise from it. My own extensive experience in two very distant and dissimilar parts of the country*, enables me to speak with the greater certainty on this head.

As few who have always remained in one corner of the country, can have had an opportunity of perceiving the influence of particulars of this sort in their full force, I shall beg leave to mention an anecdote relating to it that occurred to myself:

Some years after I had been in Aberdeenshire, two very sensible farmers, from

* The writer was born near Edinburgh, in Mid-Lothian, and practised Agriculture there for several years before he removed to Aberdeenshire.

the Lothians, came to visit me in one season, separately.—It happened, that I was fallowing a field that year, of a soil of an exceedingly bad quality, which, in its external appearance, greatly resembled some of the best fields that these gentlemen had been accustomed to see; and both of them, separately, after walking over my farm, and examining the different fields with attention, pitched upon this as the very best field in my farm, although it was, in fact, by far the worst they had seen.

One of these gentlemen had practised farming in his native place, with the greatest success, for upwards of fifty years; and the other, for more than forty.—They were both men much esteemed for their knowledge and discretion; nor was there one in the county where they lived, that could have formed a juster judgment of the value of any soil there, than they could have done.

A decision nearly similar to this, was given afterwards, by a very ingenious and successful farmer in Northumberland. The truth is, neither of them had ever
seen

seen a soil of the nature of that in question; and it was no impeachment on their judgment, if they were unacquainted with its real qualities, and therefore reasoned from analogy, that it would approach nearest to the nature of those soils that it most nearly resembled.

XLI.

Some plants can be reared only upon soils that have been manured with one kind of manure, and the growth of others is chiefly promoted by other manures.—
Wanted—A list of such plants as have their growth chiefly promoted by any one sort of manure, in preference to another.



Experience shows, that the common pea, whether white or grey, cannot be reared to perfection, in any field which has not been either naturally or artificially impregnated with some *calcareous* * mat-

* *Calcareous* is a general term, including all those substances that might be converted into lime, if unmixed with any other extraneous matter.

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ter.—Hence it happens, that peas are rarely cultivated universally as a field-crop, unless in those parts of the country where either lime, or marle, or chalk, abound, or upon strong clays. But on the sea-coast, where shell-fish are often caught in abundance, and where the fields are manured with the shells of these mixed with dung, we meet with a few exceptions to this general rule,

It is pretty remarkable, that a soil which could hardly have brought one pea to perfection, although richly manured with dung †,—if it shall have been once limed, shall be capable of producing abundant crops of peas ever afterwards, if duly prepared in other respects,

Turnip, on the other hand, will grow in any soil, if it is manured with dung;—but lime does not promote its growth in such a high degree.—Hence turnips are the first improving crop in a country destitute of lime; and peas in the other.

In countries where coal-foot is used as a manure in large quantities, the opinion

† In these cases the pea seems to haulm, and usually dies away after blossoming, without ripening the grain.
prevails,

prevails, that this manure destroys clover, while it greatly encourages the growth of rye-grass. But I have had an opportunity of remarking, that this opinion is erroneous, although it is easy to account for the way in which it has come to be so universally adopted.

For foot, although it does not destroy clover, does not, in any sensible degree, promote the growth of that plant, when applied to the ground in any proportions. I have used foot as a top dressing for clover and rye-grass, in all proportions, from one hundred bushels per acre, to six hundred *;—and I cannot say that ever I could perceive the clover upon these fields in the least degree more luxuriant than in the places where no foot had been applied.

But the effects of this manure upon the growth of rye-grass is amazing, and increases in proportion to the quantity, as far as my trials have gone.—Hence it happens, that, in fields dressed with foot, the rye-grass so far overtops the clover, that it is not seen, and the whole crop *seems*

* The bushel is not a common measure in Scotland: It is nearly the same with the pea or meal firlo.

to be rye-grass, although, in fact, there is as much clover as if it had not been manured at all.

This is a very satisfactory proof of the influence of one manure in promoting the growth of a particular plant, in preference to that of another. There are, no doubt, many others that the farmer is at present ignorant of.—I shall suggest a few.

It constantly happens, that where a heap of soot has lain so long upon the ground as to destroy all the plants upon its surface, the first plant that appears afterwards is the common couch-grass *.

It as universally happens, that the first plant that appears where a heap of common stable-dung has lain, is the common knot-grass †.

Sain-foin thrives upon the thinnest lime-stone-gravelly, or chalky soils, with great luxuriance, even where these are so poor as to afford a very scanty crop of other sorts of grass.

On much richer soils, that are not so highly impregnated with calcareous matter, that plant only languishes—on many

* *Triticum repens.*

† *Polygonum aviculare.*

occasions,

occasions, it dies entirely.—Hence sain-foin is a most valuable crop in chalky countries, —in others, it is justly thought of no value.

Lime seems to promote the growth of rye-grass, in a higher degree than it does the growth of feather-grass.—For, in fields that naturally abound with this last, and in which it even gets the better of rye-grass when it is sowed, if the ground be limed, the rye-grass flourishes and destroys the other; and when that fails, it is succeeded by white clover, and the poa-grasses, rather than by the feather-grass.

Lime, or other calcareous matter, in the soil, seems also to be necessary for the production of wheat as of peas.—I once dressed a field for wheat, which had been limed for the first time some years before that; but it happened, that one of the ridges had been accidentally missed in the liming. It was a good crop in all other parts of the field; but not one stalk came the length of producing an ear of wheat, on that ridge which had not been limed. This was only a particular case; whether it would

would happen universally so or not, I cannot say.

Calcareous matters seem likewise to be peculiarly favourable for the production of barley, more so if in very large quantities than oats. I know a field that has been often manured with the shells of muscles, &c. from a fishing town, which has carried good crops of bear *, almost without intermission, for time immemorial. Sometimes, a part of it has been sown with oats, but the crop extremely poor.

In the links at Sandside, mentioned in Vol. I. *Essay on Quick-Lime*, Aph. III. § 41, which contains a very large proportion of calcareous matter, it has been found, by experience, that bear is the most profitable crop, and therefore no other crop is ever sown upon it.—Quere, Is this the case with chalky soils?

On the contrary, oats, in general, seem to succeed better than any other kind of grain, on soils that have not been impreg-

* I am not so certain if *barley* would succeed upon such soils, but I believe it would. Barley is distinguished by having two rows of grain in the ear; *bear* has four or six rows, like wheat.

nated with calcareous matter; for which reason, it would seem that *beet*, the only other culmiferous grain commonly cultivated on such soils, is in general an unprofitable crop in countries where calcareous manures have not been used.

XLII.

There is reason to suspect, that certain manures, which operate very powerfully upon some soils, do not promote the fertility of other soils in the smallest degree. It would surely be of great use to the practical farmer, to be made acquainted with these peculiarities.



In that part of the country where I was born, and first practised agriculture, no manure whatever produced such a powerful and lasting effect, as horn-shavings.—Compared with the best yard (midding) dung, in the proportion of one stone of shavings to a cart-load* of dung, the

* Nothing is so indefinite, as a cart or waggon-load of things of this sort, that are not commonly weighed

the effect of the first was, at the beginning, about equal; but, after the first crop, the horn-shavings were greatly superior.

In Aberdeenshire, I have found the effect extremely different.—A field of a good loamy soil, little different in appearance from those on which I had formerly laid this manure with success, was fallowed, and got a thorough dressing of horn-shavings.—It has since that time carried many crops of corn and grass; but I have not been able to perceive a sensible effect of the manure on any of these crops. There has hardly been even a single tuft of grain more bushy and strong in one part of the field than another;—a circumstance that could hardly be avoided in using this manure, from the impossibility of spreading it so equally as is necessary.

Common salt is another manure, that I have tried almost with the same success. It is well known, from numberless well-

or measured; therefore, it were to be wished, that writers on agriculture would endeavour to to define them accurately.—The cart-load here meant, may be a quantity between thirty and thirty-six bushels.

authenticated

authenticated experiments, that the most ordinary effect of this manure, is to promote the fertility of the soil in a very sensible degree for a short time, when used in moderate quantities, and to check the vegetation of every kind of plant for a certain period, if employed in an over proportion*.

To try the effect of it upon my own particular soil, I fixed a pin in the middle of plot of grass, in the month of May,—and round that, as a centre, described a circle of two yards diameter. Around the inner circumference of that circular line, I strewed some common salt very thin, making it gradually thicker and thicker as it came towards the centre, till, at the pin itself, the salt lay near an inch thick upon the grass.

The whole was soon dissolved by the dews and rains, which were not copious at that season. I looked with impatience to observe the effect of the experiment,

* I have reason to be now convinced, that this is rather a vulgar error, and that common salt is inefficacious as a manure, in most cases, though in a few instances, perhaps, it may have been found to be otherwise.

but with astonishment observed, that the spot could not have been distinguished from the rest of the green, except by the pin, which was allowed to remain in its place three years.

I leave philosophers to account for these uncommon phænomena.—Let the farmer, in the mean time, be taught from them to proceed with cautious diffidence, in the application of new and untried manures. For, it is not enough that he should be *certain* they have been attended with the most beneficial effects, when tried by another :—Before he can be assured of success, he himself ought to try their effects by a *fair* experiment on a small scale, and be determined in his practice *at large* by the result of that experiment, if it has been clear and decisive.

One other practical inference may be drawn from the above-mentioned facts, which might be of service, if duly attended to.

Nothing is more common than to see writers on agriculture, who have lived in different parts of the country, accusing
one

one another of falsehood and misrepresentation; because perhaps the one has recorded an experiment, with its result,—which has been tried by the other, with all imaginable fairness, who has found the result to be extremely different.—He repeats the experiment with all the necessary precautions, but still the result is the same;—from whence he infers, that the first has told a falsehood, to support some favourite theory.

Perhaps, I myself might have been accused of this in the present case, had not my own experience furnished both the results differing so much from one another. But if soils differ so much from one another, in some of their most essential qualities, while they are not sensibly different in their external appearance, ought we not to conclude, that the circumstances which may affect the farmer are often so much concealed, as to authorise no one to dictate positively for another in all cases.—Let us then proceed with ardour in our researches, but with unceasing caution and diffidence, whenever we ex-

ceed the limits of our own proper experience.—A man who with confidence prescribes to others what should be done *in all cases*, is most certainly unacquainted with the art he professes, and must often fail.—Nor would this be so much to be regretted, did not those who are so sanguine in the opinion of their knowledge, usually advise others to proceed upon such a large scale, as must be attended with certain ruin to the undertakers, if it does not fully succeed.

Since the former editions of these Essays were printed, Gypsum has been recommended to the notice of the British farmer, as a most efficacious manure ; and many experiments that have been made, chiefly in America, have been adduced as satisfactory evidence of this fact. Some experiments have, in consequence of this, been made with it in England also, and, in most of these, it has been found to produce little or no effect. In a few cases, here also, it has been found to be very efficacious.—From hence I conclude, that, like the manures above enumerated,

rated, it only operates powerfully on certain soils, or particular crops, and that these particular soils or crops have not, as yet, been ascertained.

Thus it appears, that in whatever light we view this subject, we meet with much uncertainty and doubt. Were we to proceed forward, and consider the nature and distinguishing qualities of different soils ; —the several changes that may be produced upon these by culture, or other circumstances ; —the properties of different manures, and the effects that these, in various circumstances, produce upon the different soils ; —the mode of cultivating each variety of plants, so as to bring them to their greatest perfection ; —the effects of these upon the soil, and the consequences of all the different alternations of crops, with all the variety of collateral circumstances that branch out from these capital

heads;—we would find the same uncertainty prevail throughout the whole, as in the small part that has just now engaged our attention; and might probably meet with a still greater variety of dogmatic assertions and ill-founded opinions, maintained with a yet greater degree of obstinacy, than the few that we have had occasion to reprehend. But it was judged proper here to desist.—If, in the foregoing pages, it should be imagined that the Writer hath, on some occasions, assumed a more decisive tone than may seem to be consistent with a work of this nature, he hopes the candid Reader will be more disposed to ascribe it to that involuntary ardour which naturally arises in the mind when it contemplates objects that it deems of great importance to numbers of mankind, and the consequent eager desire it feels to correct those defects that appear to interrupt, in a high degree, the general good of society, than to any sinister cause. His only aim has been to endeavour to attain to the knowledge of useful truths, with a view to promote, to the utmost of his

his power, the general happiness of mankind:—And as the errors into which he may have fallen, are involuntary, he will think himself obliged to those who may point them out with candour, so as to enable him to correct them, if ever these sheets should come to another impression.

DISQUISITIONS

ON THE

DIFFERENT VARIETIES

OF

WOOL-BEARING ANIMALS, &c.

DISQUISITION

ADVERTISEMENT.

THIS Essay ^{THE} was written for the Bath Society, and published in the Eighth Volume of their ^{DIFFERENT VARIETIES} Memoirs, from whence it is reprinted, with considerable Additions.

WOOL-BEARING ANIMALS &c.

*Disquisitions concerning the different Varieties
of WOOL-BEARING ANIMALS, and
other Particulars connected with that
Subject. Written in the Year 1794.*

IT has been hitherto, in general, believed that the sheep is universally a wool-bearing animal, and that there is no other creature upon the globe that carries *wool*, in the strict and proper sense of the word, but sheep alone. But, there is now reason to doubt, if either of these propositions be strictly true.

Among other good effects that will result from the researches of the Society instituted for the improvement of British wool, we have already become acquainted with the nature and distinguishing peculiarities of a great diversity of *varieties* of sheep, and other animals, that were not before known in Europe. It is to that source we owe an account of the different varieties or breeds of sheep, that have been discovered in the Russian dominions, by the learned

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Dr. Pallas, so well known in the Republic of Letters, by his many ingenious Works in Natural History, and other branches of Science; a translation of which, into English, was lately published in London. By the same means, we have become now perfectly well acquainted with the Spanish sheep, and its distinguishable peculiarities; as well as with a great many other varieties of the sheep from many parts of Asia, differing from each other in a much greater degree than ever we suspected before, in Europe, was possible.

It would take up too much of the time of the Society, were I to enumerate, in detail, the individual varieties that might be specified. I shall here only briefly state, that (in as far as I yet know) all of them may be reduced to one or other of the three following classes, or the mongrel breeds resulting from an intermixture with each other, viz.

CLASS FIRST.

WOOL-BEARING SHEEP, *properly so called.*

THIS class comprehends a great many of the varieties of sheep found in Britain,
and

and throughout the greatest part of Europe. Sheep referrible to this class, are also found in Asiatic Russia, in Africa, at the Cape of Good-Hope, and in various parts of India.

Among most of the varieties of this class, unless where it has been purified by a careful selection, continued for many years, there is found intermixed with the wool, in different proportions, a kind of short, opaque, brittle, unelastic hair, usually of a dead white or chalky-colour, which is well known to manufacturers, and is easily distinguishable from other hair. It is known by the name of *stitchel*-hair in some places. In other places, it is called *kemps*; and, probably, it has many other local names, with which I am unacquainted. This kind of hair does not loosen from the skin, at the same time with the wool, and may thus be, in some measure, separated from it among some of the purer wool-bearing breeds. I have reason to believe, though I am not absolutely certain of the fact, that this kind of hair is peculiar to the sheep of this class, and is not to be found in either of the other two classes, unless, where they participate with this one in a mongrel breed.

CLASS SECOND.

HAIR-BEARING SHEEP,

Whose pile is long in the staple, and of a quality that admits of being employed in many manufactures, nearly for the same purposes as wool.

SHEEP referable to this class, have been usually confounded with the former, in so much that they have almost entirely escaped the notice of naturalists and others. The pure breeds of this sort are scarcely any where to be found among *manufacturing* nations; but they are reared, in preference to the wool-bearing sort, among the Russians, and other northern nations, where the skins of sheep, with the fleece on, are used for clothing, as they are found to be much more durable than those which carry wool properly so called. There are, however, a great many varieties among the breeds of sheep in this country, which are mongrels between this class and the former. Here, however, as in most cases, where accurate distinctions are wanted, although it seems easy at first sight to distinguish wool from hair, by the crispiness of the former, in consequence

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sequence of which, it shrinks in length, so as to require to be stretched out before it can be accurately measured, which is not the case with hair in general, yet this is found to afford a rule too vague for accurate discrimination. The following characteristics, may, I think, be sufficiently accurate to be relied on :

1st, Wool, like the body-hair of most animals, is an annual production, springing from the skin of an animal. It consists of a great number of distinct filaments, that grow more or less close to one another in different breeds ; but which spring out of the skin about the same time, like corn from a cultivated field ; advance nearly with an equal rapidity, till they have attained their full perfection of growth ; they then loosen from the skin nearly at the same period (when a new crop springs up below) and fall off in large parcels all at once, so as to leave the body, at one period, nearly bare, or covered only with a short coat of wool. Hairs, on the other hand, (such of them as are of an annual growth) only) loosen from the skin separately, and at remote periods from each other, and, unless where they are accidentally matted together,

so as to entangle the loose hairs among those that are fast; they fall off individually one by one, and are succeeded by other individual hairs to supply their place. And as this process goes on through the greatest part of the year, the length of the coat of *hair*-bearing animals, if left to themselves, is not near so different, at different seasons of the year, as that of wool-bearing animals.

Hair, indeed, as well as wool, seems to part from the animal more freely during the spring and earlier part of the summer than in the autumn and winter season; but as the hairs loosen individually, and fall off separately, and as fresh hairs seem to spring out to supply the place of those which have fallen off the moment they are displaced, as takes place with regard to the shedding of teeth among young animals, it must necessarily happen, that the pile, or, as we call it, the fur of soft-haired animals, will be thinner, and consequently less abundant in summer than in winter; a fact that has been often remarked in regard to hares, rabbits, and other fur-bearing animals, but which has not, to my knowledge, been hitherto fully adverted to. This has
been,

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been, in general, attributed to the effect of heat, physically considered ; and hence it has been inferred, that all fur-bearing animals would carry a thin coat of fur in hot climates universally ; a fact that is clearly contradicted by experience. This phenomenon seems to be connected rather with the revolutions of the seasons, like the incubation of birds, and the springing up of certain plants and flowers, at particular seasons of the year. The fleece appears indeed to be very thin during the warm season, but this is not so much because there are fewer hairs in it, but because many of these hairs are then so short, as to contribute little to the weight of the pile ; whereas, in winter, these short hairs have become longer, and thus thicken the pile by growing up among the longer hairs that have adhered to the skin during the whole of the summer season. This hypothesis seems to be strongly confirmed by a fact respecting furs that has not hitherto been much adverted to, which, I have reason to believe, prevails very universally, viz. that if a lock of the hair taken from any

kind of fur, be held by the points and combed the reverse way, a much greater proportion of it would always be combed out, than ever happens with regard to any kind of *wool* if treated after the same manner. Hence, I am, at present, inclined to infer, that this great diversity in the length of the different filaments in the same pile, is a distinguishing characteristic between hair and wool, let the fineness of each be what it may. I speak at present however only hypothetically, for I have not had opportunities sufficient to observe these facts to enable me to speak with *certainty*.

2dly, A filament of wool has no determinate proportional thickness in its different parts, but is variable in all possible proportions. Sometimes, the root-end is thicker than the points; sometimes, and indeed for the most part, in this climate, the points are thicker than the roots; sometimes, the middle is thicker than either end; sometimes, it is quite the reverse; at some times, the variation of thickness is great, and extremely perceptible; at other times, the filament is of an equal thickness throughout

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throughout all its parts. These variations in regard to the thickness of the different parts of a filament of wool, have been proved, by experiment, to depend upon the degree of heat or cold that has acted upon the animal at the time the filament was in its state of growth ; that part of it which grew during the influence of a continuation of warm weather, being always thicker than that part of it which grew during cold weather ; the difference of size varying with the difference of temperature, in all proportions, the size of the filament continuing the same only where the animal has been kept in an equal temperature of heat during the whole period of its growth.

Hairs, on the contrary, seem to have always a determinate shape and relative proportion, under whatever circumstances they shall have been produced—one species of hairs being of one shape and proportion, and another kind of another shape. In general (and with no exception, that I know of) the body-hairs of animals are thickest at the root, and taper sensibly to-

wards the point, which is directly the reverse with all wool of grown sheep in this country*.

By

* I find reason to proceed with great caution in this Disquisition, because I have not had opportunities of observing facts with the necessary precision to enable me to deduce general conclusions with the certainty I wish to do. The observation in the text is just, as far as respects the common breeds of animals that are reared in this country; but since the above was written, I have seen reason to believe, that there is a much greater diversity in this respect, than I suspected at the time that paper was written. Before that time, I had often remarked, that the kind of hair called *kemps*, which grows among the wool of our sheep, is always thicker at the roots than the points; from whence I naturally inferred, that all kinds of hair that grows up among wool, was always of the same sort. I now find that this is not the case; for the native sheep of Jamaica, which carry a considerable proportion of very fine wool, bear, at the same time, a kind of hair, intermixed among that wool, which is totally different from the *kemps* among our wool, in many respects; in particular, it is *invariably* much thicker at the points; that is to say, coarser, of greater diameter, taking each hair individually, than at the roots. It is also uniformly of a greater length than the wool, so as to cover that wool over the whole body, which is directly the reverse with *kemps*. Each of these hairs of the Jamaica sheep, is marked from the point downwards with transverse rings, of short diameter, that
are

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By these two criteria, wool may be, in general, distinguished from hair, where

are alternately black and white, so as to give it very much the external appearance of badger's hair.

I find reason, also, to be satisfied, that the form and external appearance of the hairs of different animals differ greatly from each other. Among those which have fallen under my own observation, the hairs of the *musk* animal (a fine skin of which I saw in the possession of Mr. FORSYTH, at Kensington) is, perhaps, the most uncommon I have seen. These hairs are stiff, and approach, in part, to the nature of quills, though they are much softer and more flexible than those of the hedge-hog or porcupine. They draw to a narrow point, and are much thicker at the root. Each hair has the appearance of being a flaccid tube, and is a little twisted, somewhat in a spiral form, so as to have a slight appearance of a rope.

Hairs differ also from each other in respect to the manner in which they are placed into the skin. The most beautiful variety of this kind I have seen, is that of the great polar or white bear, the hairs of which are placed all over the skin in tufts, with bare places between, exactly like the bristles in a clothes-brush. These are placed in rows with the most perfect regularity, like cabbages planted with the utmost precision in a garden, so that when the skin is folded back, either across the body, or lengthwise, or diagonally, the skin is discovered clear between them, in regular rows. Other variations, I have no doubt, take place in regard this particular, that have never fallen within the sphere of my observation.

they are entirely uncompounded, without difficulty. But as all the different varieties of sheep breed readily with each other, and produce a mongrel race, in which the discriminative qualities of the parents are blended together, it necessarily follows, that where the mongrel breed is produced between a wool and a hair-bearing race, it will afford a fleece that can neither be distinctly characterised as hair nor as wool, but will participate of the qualities of both. If this mongrel shall mix again with a wool-bearing race, the fleece of the descendant will approach nearer to wool; if with a hair-bearing race, nearer to hair; and so on, they may be blended *in infinitum*. By this means, the distinctive characteristics of hair and wool may be, in time, entirely lost, and fleeces be produced that are neither the one nor the other. This seems to be precisely the case with most of the breeds of sheep in Britain at the present day; and we must go, in some measure, out of the island, to recover the genuine breeds; but which, if attended to, will enable us to account for various phenomena that have puzzled many intelligent men.

The

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The most uncontaminated breed of wool-bearing sheep I have as yet met with, is, the Shetland breed; and there the wool rises so entirely from the skin, about the beginning of June, as to render the shearing of their sheep unnecessary. It may be plucked off at that time without occasioning to the animal the smallest uneasiness, as it will fall off of itself, if not taken away; the young fleece springing up beneath it like a young shorn fleece. The same phenomenon is observable in all the breeds of sheep in the northern parts of Scotland, where the proper time for shearing is always indicated by nature, and must be attended to. For although these sheep have got such an intermixture with the hair-bearing race as not to allow it to loosen quite so entirely as that of the Shetland breed; yet it is loosened to such a degree, that if the sheep are shorn too soon, and before the wool is properly *risen*, as the phrase there is, it is difficult to pass the sheers through it, and the skin is left very bare, the young wool not being yet grown. On the other hand, if that shearing be too long delayed, the young wool has grown to such a length as to entangle

tangle the sheers in it, so as to cut off a part of it, which is both troublesome to the sheep-shearer, and when it is thus shorn, the wool is useless. But when the wool is risen to its proper state, the sheers slide over the young fleece, and cut off the few remaining hairs of the old fleece with the utmost ease, so that the sheep discovers no marks of being new shorn, and looks like a lamb in that respect.

It would seem that there is a much greater proportion of the hair-bearing race among the breeds of sheep in the southern parts of the island; for I observe that Mr. LISLE, who lived in Hampshire, and was an attentive observer, though he had heard of this young wool, under the name of *rowety*-wool, had never seen it. It is well known in Scotland, that this phenomenon does not depend on the leanness of wool-bearing sheep, as he supposes, but takes place among those that are in the best condition soonest*.

The

* I find that most people have an idea, that the phenomenon of young wool rising at the bottom of the fleece of sheep before shearing, and all the peculiarities here mentioned, are entirely occasioned by a check the sheep have received from a want of food in the winter:

to

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The purest of the hair-bearing sheep I have seen, were some fleeces that were sent to me from the Baltic, which were as evidently hair as the fleece of a goat, though finer and softer. The Russians prefer this breed of sheep, because the fleece, when at its full length, adheres so much more firmly to the skin than wool does, that it lasts much longer when made into clothing than the other; for which reason, a wool-bearing sheep among them is a great rarity.

Among the sheep referable to this class, there are some breeds which afford a small quantity of a very fine soft wool underneath the hair, of which the *Argali* of PALLAS

to this opinion I cannot accede, for the reason after-mentioned; though I know well that when a sheep has sustained a great stress of weather during winter, it does happen that the old fleece sometimes separates prematurely from the skin; but in that case the fleece becomes matted, and assumes an appearance extremely different from the natural healthy rising above alluded to. In this last case, the wool does not separate in the early part of the spring as where it is matted; but it adheres to it till the month of June at least, and even then it loosens in a gradual manner, as the young fleece begins to rise, and always soonest upon the sheep in the best condition; which, on that account, are often shorn ten days or a fortnight sooner than the others.

is a noted example; but the greatest part of the varieties we know have none of this. I have never heard of an unadulterated breed of this kind that had stichel-hair among the fleece, though it is often found among the mongrel breeds between this and the former. Neither have I ever heard of a finer kind of wool being found at the bottom of the fleece of any of the wool-bearing breeds.

The very long wool of Lincolnshire, which I have examined with care, appears to be from a mongrel race, very nearly allied to this class, with a small blend of wool in it; and is of a harder feel than some of the pure hairy breeds, some of which are tolerably fine and soft, and very tough and durable in work, and have a fine glossy silky-like appearance. I have had wool, of the genuine wool-bearing breed of sheep, that measured $17\frac{1}{2}$ inches in length, which was extremely fine and soft, and nothing resembling that hasty kind of hair-wool in Lincolnshire.

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CLASS THIRD.

SHEEP that carry SHORT THICK HAIR, which in no respect resembles wool of any sort.

OF this variety of sheep-species we have no breeds in Britain; but that such sheep do exist, we have the clearest proofs. So little are they known, indeed, in this country, and so little is it suspected here that such an animal exists, that I was not a little surpris'd when I first saw one of this kind, and therefore examined it with a good deal of attention. This creature was on board a Danish East-India ship that put into Leith roads last season [1794] and was bought, with several others of the same sort, as they assur'd me, in the island of Madagascar. It was a ram of a good size, and was covered all over with a thick coat of short thick stiff hairs, like those of a horse, but rather stronger in the pile, and shorter. The colour was a fine brown, The hair lay close to the skin, and was very smooth and glossy, like the coat of a well-dressed

dressed horse, in fine order. They assured me, it had never had any other covering on it but what I saw, and that all his companions were of the same sort.

This fact threw the subject of sheep into a new point of view, that I had never adverted to before; and enabled me to account for some phenomena respecting sheep, that had puzzled me a good deal. In the account that Dr. PALLAS had given of the famous Bucharian lamb-skin furs, some of the peculiarities he mentioned appeared to me to be incompatible with the nature of wool, and much more nearly allied to that of hair. But, as I had no idea that any sheep of this kind existed, I was perplexed about it, and could come to no decided opinion respecting it. Since then, I have had an opportunity of seeing a night-gown, lined with Bucharian lamb-skin fur, which, I find, consists of nothing else but *hair*, without the smallest intermixture of wool. It is somewhat longer than the Madagascar sheep's hair, softer, and gently waved by means of a little curl upon it, which gives to it the beautiful foliage-like appearance for which these furs have

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have been so much valued; so that this forms a second variety of this class of sheep.

While I am just writing, I have received a letter from Sir JOSEPH BANKS, bart. on this subject; who says, "I once imported
" three sheep from Spain, which were as
" sleek and smooth as a horse, and never, at
" any season, showed the least sign of wool
" or down in the most minute quantity."

The fact, then, is incontestibly established, that sheep, which produce as little wool as horses do, exist; and, perhaps, they are much more common than we at present suspect. The Boucharian breed of sheep is kept in immense flocks, over the extensive plains of Great Tartary. I have been also assured, of late, that they have a breed of this kind of sheep in the island of Antigua.

And last winter [1796-7] I saw a sheep of this sort, in a field near Dulwich, in Kent, within three miles of the metropolis, feeding quietly, and very tame—so as to suffer me to come quite close up to it, to examine the hair. Where it had come from, I could not learn; but, it seemed to
be

be a different variety from the Madagascar sheep I had formerly seen. In colour, in particular, it was very different; the Madagascar sheep being of a clear glossy brown, this one white, with a few dark-coloured spots upon it. So that this kind of woolless sheep, seems to be by no means rare. I am assured, that the greater part of the sheep in India are of this sort, though there are also many of the wool-bearing race to be found in those regions.

A natural inference from these facts is, that since we find one class of animals, some breeds of which produce wool, and other breeds produce nothing but short hair, in no respects resembling wool, may not a similar diversity take place in regard to other classes of animals? And although it should happen that the inhabitants of one country should be possessed only of the hair-bearing breed of creatures of that sort, like the Madagascarese sheep, and know nothing of any other sort; yet, there is no reason, from that circumstance, for them to conclude, that no other breed of that kind of creature exists. This train of reasoning being suggested, it roused the mind to attend

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tend to facts; and I had soon occasion to observe, that so far from having reason to be surpris'd at finding breeds of sheep so much diversified, as above set forth, there were innumerable well-known facts, which, if adverted to, would have led to the same conclusion.

For example: there is no man in Britain, who has not had occasion to observe as great a diversity in regard to the coat of dogs as of sheep.

1st, The smooth-haired dog; examples of which, are, the Italian greyhound, and Spanish pointer.

2^{dly}, The long-haired, soft, wavy-fleeced dog; as in the English spaniel, and Newfoundland dog.

3^{dly}, The wool-bearing dog, or, at least, the dog that carries a coat, which for closeness, length, and softness, may be compared to wool, is very common. Some of them carrying an immense quantity of hair, of a long lank quality, and others carrying it of a close curled texture, very like the fleece of many kinds of sheep. The fleece of these creatures must be shorn at the beginning of summer, to let them be com-

fortably cool; and I have seen it spun and worked into stockings, which could not be distinguished from wool.

I have in my possession at present, some of the hair of a dog of this kind, that I found in London, belonging to a blacksmith, which is soft as wool, and which I find has among it a few hairs resembling, *in every respect*, that kind of hair called *kemps*, which has been hitherto deemed quite peculiar to the sheep kind.

N.B. There is a kind of fox, in Siberia, that carries a fur exactly like *wool*, as I have been assured by a gentleman who lived long there. The Russian name of it, being literally translated, is, *the little dog's fur*.

The same diversity is observable in regard to goats: as,

1st, The smooth short-haired goat, very common.

2^{dly}, The long-haired shaggy goat, very common also. The hair of this kind of goat is usually very coarse; but underneath it, as in the long-haired breeds of sheep, there is a quantity of wool, of an exceedingly fine quality, which may be separated from

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from it about the month of June, by combing. From this circumstance, it would seem that this wool, like the *wool* of the sheep, rises from the skin, and becomes loosened from it, while the hair still adheres firmly to it. Of the fineness of the quality of this kind of wool, you may satisfy yourself, by examining the small shred of a little web that will accompany this, of that kind of wool, which was manufactured under my eye here last summer. There was as much of it, as made three full-sized shawls and a waistcoat-piece, from whence the pattern sent was cut. The chain is silk, as there was too little materials to make it of wool. These shawls were compared with the finest India shawls that could be found in this place, and were deemed softer than any of them. The shawl-wool in India is precisely of the same nature, and is obtained from the Thibet goat. I have examined some Thibet goats in this country, and find their hair rather longer and coarser than the common European goat, from which it differs little. If it was a fair specimen I saw, the *wool* was rather

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less abundant on these than on the common goat.

3dly, The wool-bearing goat, for so I think the Angora goat may be called, whose hair is as fine, as soft, and as fit for work, as almost any wool; but whether it *rises* like wool, or is in this respect like hair, I have had no opportunity of observing. A specimen of Angora goats-hair, produced in Britain, will accompany this.

Whether there will ever be discovered the same diversity of hogs, I cannot tell; but we already are acquainted, in Europe, with something analogous to the two first-mentioned breeds of sheep, viz.

1st, The smooth short-haired Chinese breed. The Jamaica breed of hogs belongs also to this class.

2dly, The long-haired breed, having wool under its long bristles; of this kind, is the small breed of hogs found in Orkney and the Shetland Isles. Its bristles are very long and shaggy, and under them is found a very abundant quantity of wool, which is soft; but its peculiar qualities have not been as yet sufficiently investigated. I have
hitherto

hitherto heard of no breed of hogs that carries wool only.

Hence, it appears, that the diversity of animals that carry *wool*, is much greater than has hitherto been in general suspected; nor can we at present say, with any degree of certainty, that there may not still exist, in some corner of the globe, one or more of every species of domestic animals we are now in the custom of rearing, and that do not carry wool with us, which may also carry wool, as well as some varieties of the sheep. And since it is well known, that the inhabitants of Europe have derived great advantages from selecting the *wool*-bearing breeds of *sheep*, and rearing them in place of the smooth-haired sort; it is equally certain, that, could we discover any varieties of the other domestic animals of the smooth-haired kinds, that we have been accustomed to rear, which should afford *wool* as the sheep does, the benefit we might derive from substituting these wool-bearing breeds, instead of those hairy sorts we now propagate, would be very great, if their qualities in other respects be nearly the same.

Of all the varieties of domestic animals we have been accustomed to rear in Europe, next to the sheep, the bullock is the most valuable. We, it is true, like the inhabitants of Madagascar with regard to sheep, have been hitherto in the custom of rearing the smooth-haired bullock only; and though, perhaps, like the inhabitants of Madagascar, we may have accidentally heard that there are some varieties of this class of animals that carry something like wool, in other parts of the world; yet as these have never come to our door, and presented themselves to us, we either doubt if such animals do exist, or conclude they would not thrive with us, and therefore sit still, contented with what we have, without making any efforts to better ourselves. Is it not a well known fact, that we have continued for more than a hundred years past to import wool from Spain in great quantities every year, without ever once attempting to rear the breed of sheep that produced it, though they were in a manner at our door? And is it not also known, that instead of making a fair experiment to ascertain

certain with precision whether that wool could be produced here or not, writers have been squabbling with each other about the possibility of a thing which could never be proved *pro* or *con* by reasoning, but by fair experiment only? And is it not also a fact, that although it be now proved to demonstration, by repeated experiments, that the wool of sheep brought from Spain, does not degenerate in Britain, there has been, till this hour, no attempt made to obtain a single individual of the *finest* breed of sheep from Spain? And is it not also a fact, that because those sheep that have been brought over from Spain, at random, have not been so fine in the carcase as some of the selected and improved breeds of sheep in Britain, that different persons are still disputing about the possibility of having sheep with a good carcase from Spain; as if a fact of this sort could be ascertained without accurate trial and experiment? Thus do we sit in our elbow-chairs, and argue, without data, till we reason ourselves into indolence and inattention, that make us remain contented with the dregs only of what

might easily be within our reach. To men in these circumstances the words of the poet may be applied:

O leaden-hearted men, to be in love with death!

It is most certain, that the person who ventures to rouse the attention of men to the investigation of facts which they have not been accustomed to take notice of, must inevitably expose himself to the sneer of ignorance; but that is of little consequence, if it should chance to throw a single ray of light upon a subject that has been hitherto involved in darkness.

That there is nearly an equal diversity of breeds of cattle as of sheep, scarcely admits of a doubt; of which the following facts are proofs:

1st, The short smooth-haired breeds. Of these, the shortest I have seen, is a bull, of the *Zebu* kind, that was lately exhibited in Edinburgh, as a show. His hair did not exceed half an inch in length, and was very close, firm, and elastic. There are many breeds of cattle in Britain, the *Holderness* in particular, the hair of which is short and very smooth.

2^{dly},

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2dly, The long soft wavy hairy breeds. Of these the Lancashire cattle are a good example; and many of the Highland breeds, some of which have manes like horses.

3dly, The long soft wool-like bearing breed, of which the buffaloe, or rather bison, of Louisiana, is the chief. The hair of this animal is said to resemble clothing wool, in length, in thickness, and in closeness; a small specimen of this wool, is inclosed, which I received from Sir Joseph Banks, bart. But as the creature has never yet been domesticated, or subjected to particular observation, by men whose judgment could be relied upon, our notions of it are but very imperfect. I do not hear that there are any long hairs upon this breed of cattle.

4thly, The long-haired wool-bearing breeds. Belonging to this class there are three varieties obscurely known, viz.

1st, The *Sarluc*, by some naturallists called the grunting ox, an animal of the Southern Tartary, which is not yet sufficiently known. The fleece of this creature

is

is said to be thick and long, falling down below its knees, and of a very fine quality.

2dly, The Chittigong cow, of the higher Hindostan, which is described nearly in the same terms.—Its hair, or wool, is much esteemed by the natives, and is applied by them to various purposes.

3dly, The Musk ox, of Hudson's-Bay. This animal is much better known to me than the former, as I had the description from a gentleman in Edinburgh who lived many years in Hudson's-Bay, and who had seen thousands of them, dead and alive. The whole body of this creature, which is rather less than a middle-sized ox with us, is covered over with a very close fleece of long, soft, flexible hair, of a fine quality, which might be employed in manufactures for many of the same purposes as wool. Beneath that hair, and towards its roots, lies another coat of exceedingly fine wool, which could be applied in fabrics of the finest quality. It has been spun and worked into gloves and stockings, which are said to be as soft as silk. The buffaloe-wool inclosed, I showed to the gentleman, who
said

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said it was nothing like so fine as that of the musk-ox.

The flesh of this kind of ox is very fine, unless at the rutting season, when it acquires a musky flavour, from whence its name. Herds of many thousands of them are to be found up the country, among the Esquimaux, but none of them have ever yet been domesticated. They do not seem to be either so wild or so ferocious as the wild breed of European cattle that are still kept in Whittingham-park, Northumberland.

To show what practical uses may be derived from these facts, I shall beg leave to subjoin a few farther observations on subjects connected with this, that have resulted, in some measure, from the enquiries which have been set on foot by the wool society :

1st, It is now ascertained, that all the varieties of sheep yet known do readily intercopulate with each other, and that the progeny is a prolific animal, capable of continuing the species ; but that in respect to its characteristic qualities, it is of a *mongrel* race, participating nearly alike of the qualities

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qualities of both its parents. And as these mongrel breeds may be intermixed with other varieties *in infinitum*, it may in many cases happen, that new mongrels may be produced, in which the distinguishing peculiarities of the original breeds may be blended in all possible proportions, and lost.

In like manner, the varieties of dogs may be blended and lost, if no care be taken to preserve them; and so of cattle: At least, we know for certain, that the different European breeds may be so; and we have reason to believe, that the buffaloe, the zebu, and the other varieties that have not yet been tried in Europe, may be blended together.

2dly, The effects of climate and food, in altering the qualities of the *breed*, are found to be nothing; though the effect of these things upon the individual creature that is subjected to their influence, may, in some cases, be very perceptible. For example:

It has been shown above, that the wool of *wool-bearing* sheep is affected by heat or cold; but this is nearly in the same manner as heat or cold affect the mercury
in

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in the thermometer. It is a momentary impulse, which ceases to operate the instant its influence is withdrawn; and the animal, which may have been made to undergo great variations of heat, returns to its former state as soon as its original temperature is restored. But even this variation seems to be felt only by the *wool-bearing* breeds; and is, besides, of much less powerful influence than has been usually supposed. Nor is there is a single fact, that has ever been discovered, that gives the smallest countenance to the generally-received opinion, that heat tends either to make the fleece thinner in pile, or to encourage the growth of hairs among it; far less, that it operates, as M. BUFFON and his followers assert, in producing permanent changes on the descendants of the animals.

Heat likewise tends to accelerate the fattening of some animals, to whom it is congenial; as the hog, to an astonishing degree.

Richness of pasture also tends to produce temporary changes. On the wool; there is reason to believe it tends to augment its length

length *in some degree*, though but a little : it adds to its softness and toughness ; but, in regard to coarseness or fineness, no fact has as yet been found to ascertain that it has any sensible effect, though I am aware that *opinions* are here as decisively adopted, as if the facts had been fully ascertained. On the carcase : abundance of food is well known to augment the size of all animals to a certain degree, when compared with scanty feeding. A scarcity of food, approaching to the state of starvation, is also well known to render the wool which grows at that period of starvation, brittle and unelastic.

3^{dly}. The influence of breed, in propagating the qualities of the parent stock, or in altering the qualities of it at pleasure, by blending it with others, may be said to be all-powerful. There is not a single fact, that I have ever been able to meet with, properly ascertained, which tends to show, that the distinguishing peculiarities of any breed of animals can be sensibly changed in its essential characteristics, by any change of climate, or any other circumstance, except an intermixture of blood alone ; but innumerable

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able facts may be found that ascertain the contrary. The Persian and Arabian breeds of horses brought into Europe, are only changed by intercopulating with other breeds. The Chinese hogs may be continued for ages unchanged, if no cross be permitted. These facts are notorious; and every other fact upon this subject tends to establish the same conclusion.

4thly, Although the same breed of animals appears not to be liable to be changed by climate, or other extraneous causes, yet it is found by experience, that individuals may be met with, among every breed of animals, which are, in some lesser circumstances, different from others, though they still possess the general characteristics of the parent breed, arising from circumstances that have hitherto eluded our observation, and which it therefore exceeds our power either to accelerate or to retard. So strong also is the propensity of nature, in all cases, to produce its own kind, that if the individuals possessing these qualities, thus, as we would say, accidentally procured, whether beneficial or hurtful, be selected and put to breed with others that possess qualities

qualities somewhat of the same sort, it is found, that the descendants of these selected animals will, in general, be possessed of the distinguishing peculiarity for which they were selected, in an eminent degree; though among these also some individuals will be found to have less of it than others: And if these least approved individuals be banished from the selected stock; and those, both males and females, which possess the wished-for quality in the most eminent degree, be put to breed together, the descendants of these will be still more improved: and by continuing this mode of selection for a great length of time, the improvement, as to this particular quality, may be carried to an indefinite height. In this way, may be produced an improved breed; which, though agreeing in the general characteristics with the parent stock from which it was selected, may possess some peculiar qualities in a much higher degree than it does.

It is of much importance to the practical farmer, to advert to this peculiarity in the economy of nature, because it puts it very much within his power to benefit himself

by attention and care, in regard to circumstances that would otherwise seem to be entirely beyond his reach. For were he to be persuaded that certain peculiarities he wishes to obtain, are necessarily dependant upon a temperature of climate he never can enjoy, or that certain bad qualities in the animals he breeds are inseparably dependant upon the nature of his pasture, which it exceeds his power to change, he must of necessity sit down contented with what he has, without a hope of improvement; but if upon examining the facts above stated with attention, he shall find that the influence of breed is so powerful as is there stated, he will be at pains, in the first place, to look around him, to see if he can discover any breed possessing qualities, upon the whole, more valuable than his own, which is found to subsist on pastures of a quality not better than his own; and when he has once found them, continue, with uninterrupted attention, to select the best in all respects, particularly those that thrive best among them, to breed from. This has been done by Mr. BAKEWELL, and those who have adopted his system, with such success,

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as not only to establish the principle for which I contend beyond a doubt, but also to give room for encouraging others to adopt a similar plan for improvements in other respects, than those that seem, hitherto, to have come within the compass of his plan.

5thly, There seems to be no reason for believing that any one peculiarity we may be in quest of, is necessarily connected with, or dependant upon, any other peculiarity in the animal creation. For example: The improvers of live stock, in the present age, hold it out to view, as a general principle, that a facility in fattening is invariably connected with certain peculiarities in shape; and of course they conclude, that, wherever these peculiarities of shape are to be found, the facility of fattening will be found also, and the reverse. This, I contend, is a false principle, and I venture to say, that when the facts shall come to be thoroughly investigated, their conclusion will be found to be erroneous; indeed it is in some degree departed from in *practice* already, though in theory the principle is still adopted, without limitation. A few years ago, shortness of leg was deemed a point indispensable

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dispensably necessary in a feeding beast, and it went the length of almost being deemed—the shorter the better: this is now no longer contended for. Many of the characteristics of the present day will, in like manner, gradually fall into disuse, as people come to open their eyes on this subject. The fact is, I have seen animals that had a powerful tendency to fatten, which are almost, in every respect, the reverse of the shape most highly esteemed at present, and the contrary. And by referring every person who has had opportunities of observing *many breeds* of the same kind of animals, to his own experience, I have no doubt, but he will easily recollect instances of the same kind; or, at least, if his mind be unprejudiced, that he will soon have occasion to observe it. To that experience, then, whether past or to come, I refer on this occasion.

One circumstance, however, it is necessary here to advert to, viz. that as the breeds of animals from which the selection was begun, were originally of very good kinds, and chanced at the same time to possess those shapes that are now deemed so essen-

tially requisite ; and as the improved breeds that have been selected from these are found to possess those shapes, it is by no means an unnatural conclusion to infer, that these shapes are in some degree inseparably connected with the propensity to fatten easily. Had it chanced that equal pains had been bestowed upon selecting from another good breed that was differently shaped, the prejudice would have been equally strong, in favour of that shape. But as the breeds that have been hitherto the object of selection, have got the start of all others in point of improvement, it is probable the prejudice in favour of their shape may long continue to prevail ; nor do I wish it to be understood that I have any prejudice against the shapes recommended. Far from it, for I think them very beautiful—I only wish to say, that that circumstance is not *essentially* connected with the other ; for as every error, when admitted as a truth leads to unforeseen and often pernicious consequences, though the opinion objected to may not be of much consequence in the particular instance now under consideration, its influence
may

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may be very unfavourable in regard to others. Allow me to add one farther illustration on this head, before I put an end to this long paper :

If it be admitted, that a faculty of fattening easily be necessarily connected with certain peculiarities of shape, merely because it chanches accidentally, as I will say, that these two peculiarities happen to be united in that breed of animals which has been brought forward to notice; we ought, by the same mode of reasoning, to infer, that that quality of fattening easily, is as necessarily connected with coarseness of wool, or lightness of fleece, or any other useless or hurtful peculiarity, if it should so happen that the favourite breed chanced to have coarse wool, or a thin fleece, &c. The consequence of this conclusion would be, that every man who wished to improve the carcase of his sheep, would turn away from every breed of sheep that carried fine wool or a close fleece, as he now does from those breeds that have long legs, or what is deemed in other respects, improper shapes; and fine-woolled sheep, carrying close fleeces, would come to be entirely neglected. But

if, instead of this prevention, he should be convinced, that it might be very possible to find a sheep that would have a tendency to fatten kindly among those breeds that carry very fine wool and close fleeces; he would be as anxious to select from these breeds, as from others; and probably as successful too, if he had set out at the same time with the man who began to select from the coarse breed. I am, myself, perfectly satisfied, from a variety of facts that have fallen under my own observation, which would fill a volume nearly to enumerate, that fine wool, for example, is neither necessarily connected with thinness of pile, (the Spanish sheep carry the closest pile of fleece yet known in this country) with shortness of staple (I once had a fleece of wool, that measured 17 inches and half, which was finer than the best Spanish-wool I could buy in London, and extremely soft) with tenderness of constitution, with a tendency to fatten slowly, or with any one quality that can be named, though it may be *accidentally* connected with these: And I have not a doubt, but when the eyes of mankind in general shall be opened, so as
to

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to admit of their examining the facts that fall under their notice, without prejudice, they will be able, in time, to select breeds that shall be distinguished not only for *one* valuable peculiarity to the exclusion of all others, but even to obtain that valuable peculiarity conjoined with most, if not all the other peculiarities that can be desired. That period is, I fear, still at a great distance.

But, if these remarks shall tend in any degree to call the public attention to this subject, whether with a desire to refute or to confirm these remarks, it will equally answer the end in view, which is to remove hurtful prejudices, and to discover the truth. He who does so, is on my side, alike if he refutes by just reasoning, from well-established facts, as if he confirms these remarks.

*The SECRETARY of the Bath and West of
England Society, to Dr. ANDERSON.*

THE Secretary of the Bath and West of England Society, begs leave, in the most respectful manner, to convey to Dr. ANDERSON, some few remarks and queries, which arose in the Committee, respecting his excellent paper on Wool-bearing Animals. In general, as might be fairly expected, this paper was much approved; but doubts arising on two or three sentences, they will be set done in order, and the Doctor will greatly oblige, by giving them a reconsideration and reply, as early as shall be convenient to him.

*1st, " And is it not also a fact, that
" though it be now proved to demonstra-
" tion, by repeated experiments, that the
" wool of sheep brought from Spain does
" not degenerate in Britain*, there has
" been till this hour, no attempt made to
" obtain a single individual of the finest breed
" of sheep & from Spain?*

* Query

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* Query from the Committee. *On what experiment or experiments is this fact, if it be one, founded?*

§ From the same. *Has not the attempt been made by the king, and succeeded? Or, at any rate, are not the rams selected and sent to him by the Marchioness Del Campo, to be considered as the best?*

2dly, “Nor is there a single fact, that
“ever has been discovered, which gives
“the smallest countenance to the generally received opinion, that heat tends
“either to make the fleece thinner in
“pile, or to encourage the growth of
“hairs among it. Far less that it operates, as M. BUFFON and his followers
“assert, in producing permanent changes
“on the descendants of animals †.”

† Query from the Committee. *Is this a clear case? Do not our sheep sent to and kept at the West-Indies, rather prove the contrary?*

To JAMES ANDERSON, Esq. LL.D. F.R.S.

ANSWER

ANSWER to the SECRETARY.

DEAR SIR, *Saturday, Feb. 25th, 1795.*

I THANK you for your very kind letter of the 13th instant, which only came to hand on Thursday last; I embrace the first post for acknowledging that favour and of giving answers to the queries your Committee have done me the honour to propose.

1st, A variety of experiments have been made with the Spanish breed of sheep, for three years past, by many of the members of the Society of British Wool. I have seen many specimens of the wool of both parents, and of the progeny, which have been compared together, by the members of the Committee and others; and in no instance, has it ever been observed, that the wool of the progeny, where the breed was pure, was *coarser* than the average of the parents. Of the effects of crossing, and
other

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other peculiarities, affecting the wool in particular cases, I have not time to speak; I shall only observe, that, in general, the Spanish sheep that have come to Scotland have not been found to thrive, being liable to many diseases, especially the foot-rot. You are aware that bad health affects the *quality* of the wool, in a very remarkable degree, in some cases.

2dly, The king has certainly got sheep from Spain, as has the Society for British wool. But do the gentlemen of the Committee believe, that Mr. BAKEWELL, or any other eminent breeder, would have thought he could have obtained the very best kinds of British beasts, by getting the Duchess of * * * * *, or any other Duchess or Duke in the kingdom, to order her or his steward to buy the best, and send them to him? Such are not the steps required to make improvements of this kind. Do we not all know, that every person of high rank is liable to be imposed upon by their servants and dependants, in almost every thing? And what would have been the consequence, if the steward had

had wished to frustrate the liberal intentions of his mistress? No precautions have been adopted to guard against this. We know, that the *finest woolled* Spanish sheep have not been sent, because finer Spanish wool can be bought than any of them carried. And I have very great reason to believe, from the information of persons who have seen the flocks in Spain, that there are fine woolled sheep in Spain, much superior *in carcase* to any we have got *.

3dly, If any of the gentlemen of the Committee knows of any well-authenticated fact, which proves that the fleece degenerates, as specified, in the West-Indies, I shall be glad to be informed of it. I know of none, though I know it has been asserted ten thousand times, by persons who never had adverted to the fact; before I did advert to it, I myself believed it firmly; since I investigated the case with attention, I have

* For the precautions necessary to be observed in selecting sheep of the best sort, see Account of Russian sheep, Appendix fifth.

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been obliged to abandon that opinion *.
When the gentlemen of the committee ad-
vert

* It is very easy to account for the origin of this popular opinion. Wool is not an object of attention to any person in the West Indies; it cannot be there manufactured, and there are no uses to which they can apply it in its unmanufactured state, of course, the fleece of the sheep is entirely neglected, and in that state the wool of European sheep when carried thither will not be shorn, but will be suffered to loosen from the skin, and drop off of itself, the consequence of which will be, that if there were any kemp among the wool, which is very often the case, these hairs will remain fixed in the skin while the wool falls off; in which state the animal is perfectly bare of wool, and in its stead, the body is seen to be covered with a thin coat of long coarse straggling hairs only.—This fact being several times observed, is more than sufficient to give rise to an opinion, that all sheep which come from this country, have the wool transformed into hair, and this will naturally be ascribed to the influence of the climate, though nothing can be more certain than that the same phenomenon would take place in Britain. In fact, it does take place every year in Shetland, where the practice of sheering their sheep does not prevail. So much for the individual sheep, that have been sent out from this country.

With regard to the descendants of these sheep, as the [few sheep that go from this country are suffered to run at large among the native sheep, they of course will intercopulate with them, so that the progeny will be a mongrel

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vert to the numberless opinions that are readily admitted, without proof, as facts respecting wool and sheep in Britain, they will not be surprised at this opinion respecting sheep in the West-Indies, being admitted. I have been in the custom, for many years past, of admitting no assertion, on subjects of this sort, without proofs; and in searching for proofs on this head, I have found a great number of facts, that have obliged me to abandon my former opinion. No opinion is more universal in the West-Indies, than that the sheep which are deemed the native breed of the island of Jamaica, carry *no* wool at all, but hair only. I had an opportunity, I think, of sending to you a specimen of the natural fleece of one of those sheep, which consists, for the greatest part, of wool, perhaps *finer* (un-

grel race, approaching to the nature of the native sheep. — These being once more crossed, will approach nearer to their nature, and so on, till, in a short time, they will be in no respect distinguishable from the native sheep. — Here, then, is a pure metamorphosis of the kind—but it is a change which has no dependance on climate. — The same thing must have happened, under similar circumstances, in Siberia or Lapland, just as much as in Jamaica.

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doubtedly softer) than the best Spanish wool.

Please to accept of these hasty notices in good part, and believe me to be, with great sincerity,

Dear Sir,

Your obliged humble servant,

JAMES ANDERSON.

Mr. Wm. Matthews.

POSTSCRIPT.

ADDITIONS

Made to the above, in the year 1797.

SINCE the paper above was written, two valuable animals of the wool-bearing class have come to my knowledge; with which I was then entirely unacquainted—one of these is the Jamaica breed of sheep, concerning which, I have mentioned the nature of its hair at page 326, in putting this edition to the press. The sheep itself was discovered in Britain, by Sir Joseph Banks, Bart. who favoured me with the following account, in a letter, dated Nov. 1794. Sir Joseph had occasion to visit an acquaintance, immediately on that gentleman's return from Jamaica, and in walking upon the lawn, before dinner, he saw a sheep of a very unusual appearance.—He asked what sort of a sheep it was, and was told it was one of the native Jamaica sheep, which had been put on board for live stock, but having had a quick passage, its life had been saved. Sir Joseph, who had honoured me with some communications respecting wool
just

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just before that, expressed a desire to see its wool. Wool! said the gentleman, it carries no wool, but only hair.—Well, said Sir Joseph, let me see the nature of its fleece, whatever it be.—On that the gentleman called the sheep, which, being quite tame, came up to him.—He then plucked a lock between his finger and thumb from the back of the sheep, and looking at it for some time, he exclaimed, with some degree of astonishment—here is actually some wool, and until this moment I never did believe that these sheep carried the smallest portion of wool whatever, though I have seen great numbers of them daily for many years past! Sir Joseph examined it also, and sent the lock, exactly as it was pulled, knowing I should deem it a great curiosity. The lock consisted of hair of the kind above described, and of more than an equal quantity of wool of a singularly fine quality; being much finer than any Spanish wool I ever saw, and as soft as silk.—At that time it was about an inch long, and by the usual shearing time, I suppose it might have attained nearly to two inches in length;

and as the hair could be easily separated from the wool, seeing it is uniformly about half an inch longer, I have no doubt but the fleece of this animal, would be of as great value as the best fleeces that have been ever reared in this island; as the wool appeared to me to be equally soft with Vigonia wool, which frequently sells here, when clean picked, at the rate of one guinea per pound,—and it has the advantage over that, in being of a pure white; so that it admits of being dyed of any colour. I consider this breed of sheep, therefore, as a very proper object for experiment.

It has been, in general, believed, that the breed of sheep just now described, which are found in Jamaica, are the very same sort with those in England, which have degenerated from their original state, in consequence of the influence of the climate, which is said to convert the English wool into hair,—and it has been often seriously affirmed to me, by respectable persons, that there could be no doubt of the fact, that English sheep are invariably transformed into that kind of animal after being a few months in Jamaica. I had been, however,

ever, assured by Dr. Wright, who was an attentive naturalist, and had lived many years in Jamaica, that they were a distinct breed.—But had I never heard any surmise of that sort, nor been able to account for the prevalence of that opinion in any way, the fact above stated puts the matter beyond a doubt.—No sheep that are reared in this island, ever carried a hair of the kind which is natural to that sheep; nor have we any wool that can admit of being compared with it, in point of fineness. We have never, in short, seen any wool of the same sort in this island; and that breed of sheep seems to be more nearly allied to the Argali of Pallas, than to any other breed of sheep hitherto described. None of the breeds of sheep reared in this island, approach to it in the smallest degree. It is curious to observe that the *hair* of this animal is much coarser, and its *wool* much finer, than can be found on any of the sheep reared in Britain; so that, by the vulgar hypothesis, it would seem that the climate produced two effects on the same animal at the same time, directly the reverse of each other!

The other valuable wool-bearing animal of which I have received notice, is what has been conjectured by Dr. Anderson, of Madras, with much seeming probability, to have been the animal which gave rise to the famous Argonautic expedition, as the wool of it may, in the strictest propriety, be denominated the GOLDEN FLEECE. Hitherto it has been, in general, supposed that the epithet *golden*, was applied to the fleece of Colchis, merely allegorically in allusion to its value; but, from the specimen sent to me, it may be literally and truly called such; for I never saw any natural animal production, which so nearly assumed the appearance of gold as that does. A bit of the skin, about the size of the palm of the hand, with the wool adhering to it, was brought to Dr. Anderson, by a Sepoy, who had been employed in a military expedition to the northern parts of India, and all the account he could give of it was, that it was part of the pillage that had been obtained after the overthrow of one of the chiefs in those regions. A part of this Dr. Anderson sent to me, and it is now in
my

my possession. The pile is soft and fine ; its colour is a bright yellow, of the colour of gold, and it has a gloss lustrous as silk. In length, it is about nine inches ; nor is it frizzed up, like most kinds of wool, but hangs down with a gentle wave, tending to a kind of spiral curl upon it, very much resembling the wool of the Angora goat in every respect, except the colour. It is evidently not dyed,—for not only is the bit of skin to which the wool adheres of its native colour, but there is plainly perceptible, a small variation in the tint, between the roots and the points of the wool, the roots being rather the lighter of the two, which would not have been the case, if it had been dyed. In short, the beauty of this lock is such as to have attracted, in a very high degree, the admiration of all who have seen it ;—and even in the present state of arts, a manufacturer gave it as his opinion, that it was an article of so great value, that he would purchase it, if it could be procured, at an exceedingly high price ;—but if we look backward to those distant periods, when silk was not at all known in Europe, and

when the art of dying was but in its infancy, we can easily conceive, that the value of an article of this kind would be deemed inestimable.

We have to regret that so little is known of the animal which produces this fine fleece.—All that is as yet done, is, to ascertain that such an animal does actually exist; and that, of course, it is not beyond the bounds of *possibility* to discover it. In that enquiry, Dr. Anderson, at Madras, is engaged at present, and no man, from the great range of his correspondence, the universality of his acquaintance, and the respectability of his character in India, is so likely to succeed in the discovery of it as himself: Nor is any one so likely to procure the living animal, if it should be discovered. But such animals, if obtained, ought not to be delivered up as toys to princes, or their dependants, to play with.

Since the fact is now undeniably established, that there are various *breeds* of the same species of animals, which differ radically from each other, and preserve these distinct characteristics under every change of climate or management, while the
blood

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blood continues uncontaminated; and since we find that these variations respecting the fleece, or external coat of hair, are so very great as has been above made evident, we have reason to believe, that the variations which may take place between different breeds of the same species of animal, respecting their other qualities may be equally great and striking as those which regard the fleece; it therefore behoves us to advert to all the peculiarities of every different breed or variety of animals, with much more care than we ever yet have been accustomed to do, if we wish to carry our improvements to the highest degree of possible perfection. This opens up a tract for enquiry, that is as yet entirely unexplored; for, so long as an idea prevailed that the different varieties of the same species of animals were merely casual deviations from the same parent stock, these accidental variations must have been considered as of a nature so fleeting and perishable, as not to be worth the pain of accurate investigation.

In consequence of this mode of reasoning, the real qualities of the different

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kinds of wool and hair, produced by different breeds of sheep, have scarcely been at all adverted to, because, where a variation was perceived, it was attributed to climate, food, &c.—and not to the nature of the breed.—Hence it was inferred, that under the same temperature, and with the same food long enough continued, all the varieties would be nearly the same. By a similar mode of reasoning, we have acquired the habit of thinking the other qualities of all the varieties of any one class of animals are actually the same; and that if they appear at times to differ, this is owing to the operation of accidental circumstances only: of course, we have been equally careless in observing the other qualities as that of the wool, so that many of these peculiarities have totally escaped our notice.—I shall beg leave here to give some hints respecting these, merely to set a going this species of investigation:

The *size* of animals, like the qualities of the wool, have been supposed accidental.—That this is not the case, admits of clear proof. None of the creatures we rear, are so much under our management, or so universally

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universally subjected to our observation, as the dog; nor are there a greater diversity of breeds to be found in any species of creature.—In respect of size, in particular, this is very remarkable, for the smallest lap dog, when compared with the largest sized mastiff, is not, perhaps, one twentieth part of its bulk. And that this is not owing to the fullness of feeding, is very evident, seeing that these small dogs are in general much better fed, and more highly pampered than those of the largest size. Hence we are led to conclude, that there are varieties of the same species which are radically different in point of *size*, and which cannot be made to approach to each other, by any mode of management whatever, where the blood is unmixed.

The same thing is observable in other animals. The breed of cattle peculiar to the highlands of Scotland, may be made as fat as the Holderness breed; the Shetland breed of horses as the large black dray horses in England, and the Chinese hog as the Berkshire pig; but no management can bring these small breeds to equal
the

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the others, in point of size, when equally well fed. Observe, I do not say, that full feeding will not raise the size; for it is an undoubted fact, that every animal when well fed, will rise to a larger size than where it is not well fed; but this rule applies equally to all animals, to the larger as well as the smaller, so that if equally well or ill fed, they will still preserve their distinctive size.

Different breeds of the same species vary from each other also in respect to shape. The pug-dog, the spaniel, the greyhound, the mastiff, are all distinguishable from each other in point of shape, by the slightest glance of the eye; nor can any management tend to confound them, if the breeds are preserved unadulterated. So is the Devonshire, the Lancashire, the Holderness, the Kiloe cattle; the Shetland, the Larnarkshire, the Suffolk, the Leicester sheep; the Swedish, the Holstein, the Spanish, the Arabian horses; each of which can be recognised by a glance of the eye, when compared with the others; and they are all equally permanent.

Different

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Different breeds vary from each other also, to an astonishing degree, in respect to their propensity to increase in corpulency by abundant feeding. No art can ever bring the grey-hound to be as full of flesh, as a breed of lap-dogs (I believe they are called shock-dogs,) which have a propensity to fatten more than any others;—and, it is not a little remarkable, that some of the leanest kind of dogs, eat the most food of any, in proportion to their size. It has been often remarked, that a grey-hound is the most voracious of all dogs, and that a mastiff, in proportion to its size, eats very little, though it may very easily be fattened. The blood-horse and the alderney-cow, can never be made so fat as many other varieties of their species.

These observations lead to very important conclusions, to the farmer; for if such remarkable diversities be occasioned merely by the *breed*, it behoves him to be exceedingly attentive to this article, and to investigate, with the most careful impartiality, the peculiarities which essentially discriminate one breed from another; to consider

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consider each peculiarity of every breed, individually and separately, and not to blend them in the gross, as has hitherto been done. It would lead me much farther, than I at present choose to go, were I to enter minutely into this subject—my object is not at present to teach others, but merely to put them into a train of instructing themselves; and, with that view, I shall merely glance at a few other circumstances, before I put an end to this Essay.

It is not the abundance of food, that will produce a large breed of animals in any place, though the want of food will every where stint them in size. Hence we are not to conclude, that wherever a small breed of any domestic animal prevails, it must be a poor barren country.—If the animals be fat, it is a proof they have abundance of food, whatever be their size—though if they be thin, it is not a proof that they are in want of food. The Shetland poney is of a size as small as that of the island of Tiree; but the first is a plump strong-made animal, that is almost continually fat, the last is a thin
puny

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puny creature, that looks always starved, though its native food is richer. In like manner, the Alderney-cow is a hard-boned, hungry, starved-like creature, when even on the best of grass. The Kiloe is not much higher in stature, but it is a burly looking creature, compared with the other, and has a tendency to fatten kindly wherever it has food enough. The first is a native of a fine climate and good soil; the last is found in an ungenial region, and very unfertile country.

From these considerations, it will appear, that several of the questions which have been keenly agitated among warm disputants, for many years past, do not admit of a solution in the way they have contended for. One party, for example, maintains that it is more advantageous to rear large than small beasts; and, in confirmation, he produces a fact, by which it appears, that in that particular case, the large beasts were, in truth, the most profitable of the two. Another, on the contrary, maintains, that small beasts are universally more profitable than large, and states a fact, which proves clearly, that the

the small breed was indeed more beneficial than the large. They may be both right as to the particular facts alleged, and both wrong as to the general conclusion. It is not the size, but the other peculiarities of the individual breeds that influence this question; seeing two breeds, of equal size, may possess properties extremely dissimilar. It is, therefore, a groundless prejudice, either to approve or to condemn a particular breed, from adverting to its size only; of course, we ought to reject none from the particular investigation of its qualities, above recommended. For this reason, the Musk ox, of Hudson's Bay, which is rather small; the Bison of Louisiana, which is of a larger size, and strong, both of which fatten kindly; the Alderney-cow, which is also small, but valuable on account of its milk; and the Arnee, of Hindostan, which is by far the largest of the cattle-tribe yet known, should each of them have their respective peculiarities distinctly ascertained.

Of all the animals of the *Bos* tribe, the Arnee is, doubtless, the largest yet known;

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known; and although largeness of size be not in itself a quality that ought to recommend an animal to favour; especially where it is to be suffered to graze upon the meadows, where the exorbitant weight of the creature may be sometimes hurtful; yet, there may arise occasions, in which great bodily strength may be of singular utility: and as it is possible to feed beasts always in the house, should the animal be in other respects desirable, the damage that might be done by its weight in pasturing, may be thus entirely avoided. This creature, when tamed, is gentle, and very susceptible of being trained to any purpose that may be wanted; but, with its other qualities, we are very little acquainted. It is known in the higher parts of India, where it is used as a beast of parade, nearly in the same manner as the Elephant, to which, in point of size, it more nearly approaches, than, perhaps, any other animal, that is yet known to us, as I chanced accidentally, to gather from the following incident:

Mr. William Haig, while first lieutenant, on board the Hawkesbery East Indian,
diameter,

diaman, then in the river of Ganges, about fifty miles below Calcutta, observed an animal in the river, alive, but floating towards the sea, carried down by the current; a boat was immediately put off, and the creature secured by means of a rope thrown over its horns, and towed towards the ship. They were surprized at the largeness of the size of the animal; and being just come into the river, from Europe, it was accounted a glorious prize, and instantly slaughtered for the sake of fresh provisions. It was found to be a bullock of only two years old, yet when cut up, the four quarters weighed full 1450 pounds. From this datum we cannot suppose, that a beast of this kind, of full stature, and completely fatted, would weigh less than 4500 pounds; for we know that a lean bullock, of two years old, will not amount to one-third part of the weight that the same animal would have attained at nine years of age, when fully fatted; and as this creature must, in all probability, have been carried down the river for, perhaps, a thousand miles, before it was caught (none of these cattle, that

I have

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I have heard of being bred, lower than Plassy) we must suppose that it would be very much emaciated; yet all on board the ship thought it excellent eating. As the head, feet, skin, entrails, and tallow, of a fatted animal, weigh very little less than the four quarters, we shall see reason to believe that some of these, when alive, may be found, which will not be less than from 80 to 90 cwt. upwards of four ton weight! so that it must be a very stately creature. They are said to be sometimes eleven or twelve feet in height.

The horns of this breed of cattle grow right upwards, nearly in the same plane with the face. At first they spread outward, but as the creature grows older, they gradually bend inward, till at last they form nearly a circle, of a large size. I saw an Indian painting, in the possession of Gilbert Innes, esq. of Stow, in Edinburgh, representing a fight between an elephant and two tigers; a kind of entertainment, sometimes given by the grantees of India, for the amusement of the public. In this painting many people were present; some elephants were there also, under the care of attendants, and

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three of these cattle were there seen also, standing quietly, under the charge of their keepers, who were mounted upon them, nearly as the cornac is upon an elephant; nor were they represented as much, if at all, inferior in size to that monstrous animal.—The colour was uniformly black, except a tuft of red, or rather flame-coloured hair, pretty long, on the top of the forehead, exactly between the horns. It was guided by a rein fastened to the gristle between the nostrils. It is therefore plainly a domesticated animal, and its appearance is of the most gentle and inoffensive kind.

The Bison, or, as it is commonly called, the Buffaloe of Louisiana, is also a beast of a large size, and great bodily strength, and has a propensity to fatten kindly. It was not known that it could be very easily domesticated till of late; but I find, among other peculiarities respecting this creature, mentioned in the Seventh Volume of the Bath Society papers, written by a Mr. Turnbull, a very singular and easy method of catching them, which appears to be well known to the inhabitants of the back settlements

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tlements in America, who often go out to hunt the Buffaloe. He states, that if a female who has a sucking calf at her foot, chances to be killed, the calf never leaves its dam even when the hunter comes up, but stands quietly by, and follows the body of its mother wherever it is carried, were it even into the heart of a city ; and as the calf is easily tamed when once got into hand, it seems to be often reared, in the back settlements as a domestic animal. The writer of that paper does not there specify any of its other qualities, but its strength alone, which, he says, is much greater than that of the European ox, and its step longer, on which account he strongly recommends it as a beast of draught.

The *Zebu* breed of cattle has been also imported into this country, I find, from India, by several gentlemen, and is found to thrive here, and to breed perfectly well, so that it is probable, its qualities will come in time to be accurately ascertained. In regard to one particular, both these breeds possess a peculiarity, that is well known to be totally distinct from any of the breeds of cattle that are natives of this country. The

peculiarity which distinguishes the Bison from other varieties of the *Bos* tribe, is a large hump upon the shoulder, which when cut up, is found to afford a flesh that is of a quality totally distinct from that of any other part of the body, and is universally esteemed much more delicate eating. The *Zebu* is also distinguished from other creatures of the same genus, by a particular kind of excrescence, that rises from the shoulder also, but in a manner totally different from that of the Bison; and the quality of the flesh of this excrescence (which is of a considerable size) is different from any meat furnished by our cattle, and differs also from that of the Bison. This is deemed such a peculiar delicacy, that I have often heard gentlemen who have been used to it in India, say, they found all the meat in this country, harsh to their palate, so that they could with difficulty bring themselves to eat of it. It is not impossible but the meat in the other parts of the body may also differ considerably from our's, and from each other. The skin also of these animals may be found, upon trial, to be possessed of properties that may render it highly valuable

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luable in manufactures; particularly that of the *Arnee*, which is probably, in many respects, different from that of the smaller animals of the same genus. It is certain, that the Indians make of the skin of the Bison, manufactured in their manner, a kind of leather, that is soft, tough, and very light, of which they form a kind of jerkin, or a shield, perfectly capable of resisting the force of an arrow. Whether this quality depends upon the nature of the skin, or on the mode of manufacturing it, remains to be ascertained.

I shall just add one other hint respecting *varieties* of animals of the same species, with a view to lead to an investigation, that never has yet, that I know of, been the subject of elucidation. We have seen above, that different *varieties* of the same species possess certain permanent and distinct peculiarities, that cannot be altered but by an intermixture of blood. Those peculiarities that I have taken notice of above, respect chiefly external circumstances, which are very obvious to the senses.—There are other peculiarities, however, of a more obscure nature, if I may be allowed

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to adopt that expression, which, though equally useful, are not so easily ascertained by sensible marks which admit of accurate comparative trial, but which are still easily recognised, when you take two breeds that differ very much from each other.—Of this nature, is what is called hardiness, or persevering firmness under fatigue, often called *spirit*—as contrasted to that sluggish want of mental and muscular exertion, which is called *softness* in horses; the blood-horse, for example, and some other noted breeds of active horses, compared with the large black dray-horse. Of a nature equally obscure, though I am satisfied too equally distinct from each other, is the taste and flavour of the flesh of different breeds of the same kind of animal, though this circumstance does not seem as yet ever to have attracted the public attention in the smallest degree. Every person knows, however, that there is an exceedingly great difference between the delicacy of the meat he eats at different times; but as it is well known that the flavour of meat may be affected by circumstances that are totally unconnected with the breed, such as, in
some

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some kind of animals, the age at which they have been killed, or the nature of the food upon which they have been fed, or the time the meat has been kept after it has been slaughtered ; and as no pains is, in general, taken to discriminate how far either of these circumstances have tended to operate in the particular case in question, each individual feels himself, in general, disposed hastily to conclude, that the particular circumstance which he chances to have fixed upon as obnoxious, or the reverse, has occasioned the good or the bad flavour he perceives. Is his mutton peculiarly delicate—one man immediately concludes, it must have been fed upon heath, which gives it the high flavour.—If bad, it has been fed upon turnips ; or it is, perhaps, the age—or the size—or any other circumstance that may chance to operate upon his imagination at the time—but he seldom thinks of ascertaining with the necessary degree of precision, whether this be the fact or not. I myself know, for a certainty, that I have heard things of this nature repeatedly mentioned as facts that were incontestible, which I knew at the time to be totally dif-

ferent from what was asserted, when it would have been very idle, or very rude in me to have contested it: neither have I myself had opportunities of ascertaining the fact referable to this head with the necessary precision to be able to lay down any rules that can be relied upon. My observations go no farther than to furnish me with reasons for doubting; but they have been long enough continued to authorize me to suggest hints for farther investigation. In short, I have seen reason to be satisfied that, independant of age, and food, and every other circumstance which tends to affect the taste of meat, there is a flavour peculiar to the meat of every distinct breed of domestic animals that are reared in this island, which can only be changed by blood. I do not say that this flavour cannot be altered by the circumstances above stated;—far from it—for I know that the alteration that may be produced by these means is always very great. What I mean is simply this; that under the same circumstances respecting age, food, and every other particular, the flavour of the meat of two distinct breeds will be different, in most cases.

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In regard to mutton, I shall beg leave to specify the true Welsh breed, and the new Leicestershire, as the greatest contrast to each other that I know.—The first I conceive to be by much the finest flavoured mutton I have seen, and the last the lowest.—The difference is to me nearly as great as between a golden pippin, and an ordinary apple. Whether this difference of flavour depends upon the breed or the feed, may be ascertained by very easy experiment. Let any gentleman who has a convenient inclosure, buy a score of lambs of one year old, of each kind; let them be turned together into as rich a pasture as you please, and let the two best of each kind be always chosen at the same time, when wanted, and then slaughtered, and treated in every respect alike, till the whole shall be consumed, as they advance in years. Two of the same age will thus always be compared together; if no difference in the flavour be then perceived, I am clearly in a mistake.—Many other good consequences, besides that here stated, would result from this experiment, if conducted with

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with accuracy, and faithfully recorded ; and it would cost nothing.

I shall just add, that I have reason to suspect that the delicacy of flavour is by no means necessarily connected with the *size* of the breed ; for though, in this instance, it should be found that the smallest is preferable, I have no doubt but that in other trials it would be found that the reverse would be the case.

APPENDIX.

A P P E N D I X.

A P P E N D I X

APPENDIX.

LINNÆUS, who is justly celebrated for his knowledge in the different branches of *Natural History*, gave the first hint for beginning the following set of useful experiments in rural economy, which were afterwards prosecuted by some of his pupils, and published in the *Amœnitates Academicæ*, under the title of the *Swedish Pan.*

The design of this truly valuable set of experiments was, to ascertain which of all the plants common in Sweden were eaten, and which of them were refused by the five most valuable domestic animals—oxen, cattle, horses, sheep, and swine—that it might serve as a direction to the rural improver, in the choice of plants proper to be cultivated by him for any particular purpose; as also to enable him to know what species of animals it would
be

be most profitable for him to allow to be fed with the produce of any field, in its natural state.

Mr. Stillingfleet translated into English the Introduction to this set of experiments; but he omitted the experiments themselves, on account of the difficulty of making ordinary readers know the plants by the names that were given them.

I am not satisfied that this reason is sufficient to prevent a translation of this set of experiments from being of some use even to the English reader, as few persons are unacquainted with many of the plants by their English names; and as there are fewer still, who have the smallest spirit of enterprise, who may not have an opportunity of getting the particulars about which they may be in doubt, explained by some of their acquaintance, if they really are desirous of it.

On this account, I have chosen to publish the experiments themselves, having subjoined the English names given to the several plants, taken from Hudson's *Flora Anglica*; to some of which, I have added such

such vulgar names as have come to my own knowledge.

I have likewise been tempted to undertake this, in some measure, with a view to excite a desire of attaining an adequate knowledge of botany, among philosophic farmers, who would reap many benefits from a competent proficiency in this science.

The utility of this branch of science, will appear plainly from the perusal of the following set of experiments. For, without its aid, it would have been impossible for any inhabitant of Britain to be benefitted by any of the facts contained in them; as it would not have been possible for them to know, with certainty, any one plant mentioned through the whole of these numerous experiments; whereas, it is now easy to know, with the utmost certainty, every herb that occurs.

Those who view botany in this light—who consider it as a necessary step of that ladder by which they may be enabled to attain useful knowledge, will look down with equal contempt on those who rest
satisfied

satisfied with being able to name every plant that may occur to them, and consider this as the ultimate use and end of this science; as of those who, with a fastidious pride of mind, despise this pursuit, as mean and ignoble, and glory in their ignorance of a science they think unworthy of the attention of men who are busied in pursuits of things of real utility.

It is, indeed, no more, at best, than a vocabulary, and although it be possible for one to learn all the words of a vocabulary, without attaining any knowledge of the language; yet, it is impossible for a stranger to that language to attain a knowledge of it, without first retaining in his memory the words of which it consists; which he will best attain by the aid of that vocabulary.

The science the botanist ought to wish to attain, is the *knowledge of plants*.—The several systems of botany that have been invented, pretend to do no more than to class these plants in such a manner, as to facilitate the attainment of their names:—It is, therefore, of the greatest importance,

ance, as a *mean of attaining knowledge*; but as an *ultimate end*, it is, perhaps, the most trifling pursuit that can occupy the mind of man.

A man who values himself for his knowledge in this mere system of classification, without aiming to make it of any other use, exactly resembles him who should glory in being able to repeat with facility all the words of any unknown language.— If the mere botanist adds any thing new, he may be of some use to others by abridging their labour, but must be considered as the veriest dunce of a drudge that ever existed. His life is spent in the arduous pursuit of a shadow, instead of a reality.

Linnaeus, although he has done more to assist others in attaining the names of plants with certainty and facility, than perhaps any other man, seems to view the science in its proper light; as he has endeavoured to extend the views of his pupils to the desire of discovering such plants as are possessed with qualities that may be of use to mankind. The following set of experiments is one satisfactory proof of

this ; and many others might be produced, were this a proper place for it.

We have reason to regret, that other eminent Naturalists, who live in other parts of the world, have so seldom followed his example in this respect. And it ought to cover them with shame, when they reflect, that under the influence of this single man, the small and inconsiderable kingdom of Sweden should have produced a greater number of really valuable experiments on the uses of plants, and other natural bodies, within these few years, than perhaps all Europe besides ; although the attainment of knowledge there is much more difficult than in many other places ; and although it is next to impossible for the most successful experimenter to publish his discoveries to the world, without almost a certainty of losing by the publication.

The following Experiments were published by Nicolas Hasselgreen, in the year 1760,—who, after having mentioned the first hint for this purpose that was given by Linnæus, in the Relation of his Journey to Dalicarlia, *anno* 1743, and taking notice

that his disciple Professor Kalm, in imitation of him, mentioned some of the plants that cattle ate or refused, which he had occasion to remark in a journey he made to Bahus, he adds,—

“*Anno* 1747, and 1748, our President (Linnaeus) undertook, with great diligence, not only to make experiments himself, but to excite his disciples and auditors to do the same; of which I was one. Thus at last many experiments were made, and repeated, especially by D. D. Hagstrom, Mag. E. G. Liidbeck, E. Ekelund, J. G. Wahlbom, L. Montin, F. Olbders, J. C. Forskahl, A. Fornander, not to mention others who have strove as it were to outdo one another in finding the plants which were most suitable for different animals.”

When shall Britain be able to produce such a fraternity, emulously contending who shall most promote such another set of useful experiments?

By this means, they were enabled to produce above two thousand certain experiments, some of which were repeated, he assures us, ten times over, and some of them twice as often.

The plants were chosen when the leaves were in perfection, and were handled as little as possible before they were given to the different animals. They were offered to these animals when their bellies were pretty full; and every possible caution was taken to obtain a perfect knowledge of what they voluntarily ate, and what they rejected.

It is not, however, to be doubted, that, should the same experiments be repeated by others, the result might differ in many instances.—Some individual animals are much nicer in their taste than others, *naturally*; — others, from *habit*, may be induced to eat with pleasure many plants that they would have at first refused. From which circumstance, the result of the same experiment, tried at different times, on different animals, might vary.

Nevertheless, it may, in general, be allowed as an undoubted fact, that whatever plant has, in any of these experiments, been eaten by any class of animals, will in general be eaten by other animals of the same class, if proper means are used for inducing those

that are shy at first to taste it, and become acquainted with it.

But it is by no means certain, that although all the animals of one class have refused a particular plant, other animals of the same sort will on no occasion be induced to eat of it. I shall have occasion to take notice of several instances of this sort that have come to my own knowledge, which shall be subjoined, by way of Notes, to the Table of Experiments.

In the Table that follows, the Latin generic name of the plant is first given in Roman characters, after which follows the name of the species in *Italics*—which is succeeded by the English name, taken from Hudson's *Flora Anglica*,

The following letters indicate the duration of the different plants:—A signifies an annual plant; B, a biennial; P, a perennial; T signifies a tree or shrub; and the numbers I. II. III. &c. show the times of their flowering, viz. I. January, II. February, III. March, &c.

The five columns on the right hand serve to denote the five domestic animals, to which the plants have been offered.

The first marked O. *oxen*—the second G. *goats*—the third Sh. *sheep*—the fourth H. *horses*—and the fifth Sw. *swine*.

The marks in these columns opposite to the name of every plant, show whether that plant was eaten or refused by the animals expressed in each column.—By the mark (1) is denoted that the plant was eaten; by the mark (o) that it was refused; and by both of these (1o) or (o1) that it was sometimes eaten and sometimes refused: The letter (n) denotes that it was not tried with the particular animal in whose column it is placed, although there is no explanation of this in the original work.

The Swedish Naturalist arranged the plants according to the order they hold in the *Flora Suecica* of Linnæus.—I have thought it better to alter that arrangement to one which I imagine is better adapted to the use of the farmer,—and which is divided into classes, according to the number of animals that eat each plant.

The first class (§ I) contains such plants as were either eaten by all the five classes of animals, or only rejected by one of them.

The

The second class (§ II) contains those that are eaten by four, or rejected only by two.

The third (§ III) contains those that were eaten by three, or rejected by three.

The fourth (§ IV) contains those that were eaten by two, or rejected by four.

The fifth (§ V) contains those that were not eaten by any animal at all.

This arrangement is only broken through in some cases, where a plant or two are placed with others of the same species, although differing a little from the others.

There are in the original Table, many plants that were not tried at all.—These are here entirely omitted.

To assist the reader to turn to any plant he may wish to examine, a Latin and an English Index are subjoined.

A TABLE, showing what Plants are eaten or neglected by the five most common Domestic Animals, Oxen, Goats, Horses, Sheep, and Swine.

§ I.

Plants that were either eaten by the whole five animals, or only rejected by one.

		O.	G.	Sh.	H.	Sw.
1	<i>Veronica officinalis.</i> Male speedwell, P V.	x	i	i	i	o
2	— <i>scutellata.</i> Narrow-leaved water speedwell, P VI.	i	i	i	i	n
3	— <i>agrestis.</i> Germander speedwell, or chickweed, A V.	i	i	i	i	n
4	— <i>hederifolia.</i> Ivy-leaved speedwell or small hen-bit, A IV. V.	i	i	i	i	n
5	— <i>triphyllus.</i> Trifid speedwell, A V. VI.	i	i	i	i	n
6	<i>Anthoxanthum odoratum.</i> Vernal or spring-grass, P VIII. Tab. IX.	i	i	i	i	n
7	<i>Milium effusum.</i> Millet-grass, A VI. VII.	i	i	i	i	n
8	<i>Aira cæspitosa.</i> Turfey hair-grass, P VII. VIII.	i	i	i	i	o
9	— <i>flexuosa.</i> Small hair-grass, P VII. VIII.	i	n	i	i	n
10	— <i>Montana.</i> Mountain hair-grass, P VII. VIII.	n	n	i	n	n
11	— <i>cærulea.</i> Purple hair-grass, P VIII.	n	i	i	i	n
12	— <i>canescens.</i> Grey hair-grass, P VII.	i	i	n	n	n
13	<i>Poa aquatica.</i> Reed meadow-grass, P VII.	o	n	i	o	n
14	— <i>compressa.</i> Creeping meadow-grass, A VI. Tab. VIII.	i	i	i	i	n

		O. G.	Sh. H. Sw.
15	<i>Poa annua</i> . Annual meadow-grass, or Suffolk-grass, A VI.—IX.	I	I
16	— <i>pratensis</i> . Great meadow-grass, A VI. Tab. VII.	I	I
17	— <i>angustifolia</i> . Narrow-leaved meadow-grass, A VII.	I	I
18	— <i>trivialis</i> . Common meadow-grass, P VI. VII.	I	I
19	— <i>alpina</i> . Alpine meadow-grass,	I	I
20	<i>Briza media</i> . Middle quacking-grass, cow-quakes, and ladies-hair, P VI.	I	I
21	<i>Cynofurus cristatus</i> . Crested dog's-tail-grass, P VIII. Tab. X.	I	I
22	— <i>ceruleus</i> . Blue dog's-tail-grass, P VII.	I	I
23	<i>Dactylis glomeratus</i> . Rough cock's-foot-grass, P VI.—VIII.	I	I
24	<i>Bromus scaberrimus</i> . Field brome-grass, A V. VI.	I	I
25	— <i>arvensis</i> . Corn brome-grass, P VII.	I	I
26	— <i>giganteus</i> . Tall brome-grass, P VIII.	I	I
27	— <i>pinnatus</i> . Spiked brome-grass, P VI.	I	I
28	<i>Festuca fuitans</i> . Flote fescue-grass, P VI. VII.	I	I
29	— <i>rubra</i> . Purple fescue-grass, P VI. * Tab. III.	I	I
30	— <i>ovina</i> . Sheep's fescue-grass, P VI. VII. Tab. IV.	I	I
31	<i>Avena pratensis</i> . Meadow oat-grass, goose-grass <i>vulgo</i> , P VII.	I	I

* Sheep, I have found, delight much to pasture on fields that abound with the purple fescue-grass, and eat them quite bare.

		O.	G.	Sh.	H.	Sw.
32	<i>Avena fatua</i> . Bearded oat-grass, P. VIII.	-	-	-	-	-
33	— <i>elator</i> . Tall oat-grass, knot-grass <i>vulgo</i> , P. VII. VIII.	-	-	-	-	-
34	<i>Arundo phragmites</i> . Common reed-grass, P. VII.	-	-	-	-	-
35	— <i>calamagrostis</i> . Branched reed-grass, P. VI. VII.	-	-	-	-	-
36	<i>Triticum repens</i> . Common wheat-grass, dog's-grass, quick-grass, or couch-grass, P. VI.—VIII.*	-	-	-	-	-
37	<i>Scabiosa arvensis</i> . Common field-scabious, P. VIII.	-	-	-	-	-
38	— <i>columbaria</i> . The lesser field-scabious, P. VIII.	-	-	-	-	-
39	— <i>succisa</i> . Devil's-bit, P. VI.—VIII.	-	-	-	-	-
40	<i>Asperula odorata</i> . Woodroof, P. V.	-	-	-	-	-
41	— <i>tinctoria</i> .	-	-	-	-	-
42	<i>Galium aparine</i> . Cleavers, or goose-grass, A. V. VI.	-	-	-	-	-
43	— <i>uliginosum</i> . Marsh-goose-grass, P. VII. VIII.	-	-	-	-	-
44	<i>Sanguisorba officinalis</i> . Burnet, P.	-	-	-	-	-
45	<i>Anchusa officinalis</i> . Hounds-tongue, P. VI.	-	-	-	-	-
46	<i>Asperuga procumbens</i> . Small wild bugloss, great goose-grass, and German madwort, A. IV. V.	-	-	-	-	-
47	<i>Ulmus campestris</i> . Common elm-tree, P.	-	-	-	-	-

* This grass is not much liked either by oxen or horses. The roots of it are relished by cattle.

		O.	G.	Sh.	H.	Sw.
48	<i>Lasertitum latifolium.</i>	-	-	-	-	-
49	<i>Heraclium spondylium.</i> Cow parsnip, B VII.	-	-	-	-	-
50	<i>Pimpinella saxifraga.</i> Small Burnet saxifrage, P VIII.	-	-	-	-	-
51	<i>Convallaria bifolia,</i>	-	-	-	-	-
52	<i>Rumex acetosa.</i> Common sorrel.	-	-	-	-	-
53	— <i>acetosella.</i> Sheep's-sorrel, P V. VI. VII.	-	-	-	-	-
54	<i>Triglochin palustre.</i> Arrow-headed-grass, P VII. VIII.	-	-	-	-	-
55	— <i>maritimum.</i> Sea-spiked-grass, P V. VI.	-	-	-	-	-
56	<i>Sorbus aucuparia.</i> Quicken, rawen-tree, or mountain-ash, T V.	-	-	-	-	-
57	<i>Pyrus communis.</i> The wild pear-tree, T V.	-	-	-	-	-
58	— <i>malus.</i> The apple-tree, T IV.	-	-	-	-	-
59	<i>Mespilus cotoneaster.</i> The medlar, T V.	-	-	-	-	-
60	<i>Rosa canina.</i> Dog-rose or hip-tree, T V. VI.	-	-	-	-	-
61	— <i>spinossima.</i> Burnet rose, T VI.	-	-	-	-	-
62	<i>Rubus idaeus.</i> Raspberry-bush, T V. VI.	-	-	-	-	-
63	— <i>fruticosus.</i> Bramble, T V.—IX.	-	-	-	-	-
64	— <i>caesias.</i> Small bramble, or Dewberry-bush, T VI.	-	-	-	-	-
65	— <i>saxatilis.</i> Stone-bramble, P VI.	-	-	-	-	-
66	— <i>chamemorus.</i> Cloud-berries, or knout-berries, P V. VI.	-	-	-	-	-

					O. G.	Sh.	H. Sw.
86	<i>Geranium robertianum</i> .	Herb Robert, B IV.	-	-	n	i	o
87	— <i>cicutinum</i> .	Hemlock-leaved cranebill, A IV.—VI.	-	-	i	n	o
88	<i>Polygala vulgaris</i> .	Milkwort, P V. VI. Tab. XI.	-	-	i	n	o
89	<i>Genista tinctoria</i> .	Green-wood, dyers-weed, or wood-waxen, T VII.	-	-	i	i	o
90	<i>Astragalus glycyphyllos</i> .	Wild liquorice, P. VI. VII.	-	-	i	i	o
91	<i>Anthyllis vulneraria</i> .	Kidney-vetch, or lady's-finger, P VII.	-	-	i	n	n
92	<i>Orobanchus tuberosus</i> .	Wood-peas, or heath-peas, P V.	-	-	i	i	o
93	— <i>niger</i> .	Black wood-peas,	-	-	i	i	o
94	— <i>vernus</i> .	Early wood-peas,	-	-	i	i	o
95	<i>Lathyrus sphaerolobus</i> .	Narrow-leaved peas everlasting, P. VII. VIII.	-	-	i	i	o
96	— <i>heterophyllus</i> .	-	-	-	i	i	o
97	— <i>pratensis</i> .	Tare everlasting, or common yellow-vetchling, P VII. VIII.	-	-	i	i	o
	Tab. XII.	-	-	-	i	i	o
98	— <i>palustris</i> .	Marsh chickling vetch, P VII. VIII.	-	-	i	i	o
99	<i>Vicia sativa</i> .	Common vetch, or tare, A V. VI.	-	-	i	i	o
100	— <i>sepium</i> .	Bush vetch, P V. Tab. XIV.	-	-	i	i	o
101	— <i>spicata</i> .	Tufted wood vetch, P VII. VIII.	-	-	i	i	o
102	— <i>cracca</i> .	Tufted vetch, P. VII. VIII.	-	-	i	i	o
103	<i>Ervum tetraspermum</i> .	Smooth tare, A IV. V.	-	-	i	i	o

						O. G.	Sh.	H. Sw.
104	<i>Ervum hirsutum.</i>	Hairy tare, A VI.	-	-	-	I	I	I
105	<i>Pisum arvense.</i>	Common peas, A	-	-	-	I	I	I
106	— <i>maritimum.</i>	Sea peas, P VII.	-	-	-	I	I	I
107	<i>Lotus corniculata.</i>	Birds-foot trefoil, P VI.—VIII.	-	-	-	I	IO	IO
108	<i>Trifolium repens.</i>	Dutch clover, white trefoil, P VI.—IX.	-	-	-	I	IO	IO
109	— <i>pratense.</i>	Purple or honeysuckle trefoil, T V.—IX.	-	-	-	I	I	I
110	— <i>arvense.</i>	Hares-foot trefoil, A VII. VIII.	-	-	-	I	I	I
111	— <i>agrarium.</i>	Hop trefoil, A VI.	-	-	-	I	I	I
112	— <i>procumbens.</i>	Decumbent, or creeping trefoil, P V.—VIII.	-	-	-	I	I	I
113	— <i>melilotus.</i>	Common melilot, B VI. VII.	-	-	-	I	I	I
114	<i>Medicago falcata.</i>	Yellow medick, P VII.	-	-	-	I	I	I
115	— <i>lupulina.</i>	Melilot trefoil, A V.—VIII.	-	-	-	I	I	I
116	<i>Ononis mitis.</i>	Creeping-rest harrow, P	-	-	-	I	I	IO
117	— <i>spinsa.</i>	Rest-harrow, or cammock, P. VI.—VIII.	-	-	-	I	I	IO
118	<i>Sonchus arvensis.</i>	Tree sow-thistle, P VIII.	-	-	-	I	I	I
119	— <i>oleraceus.</i>	Common sow-thistle, A VI.—VIII.	-	-	-	I	I	IO
120	— <i>alpinus.</i>	Mountain sow-thistle,	-	-	-	I	I	I
121	<i>Prenanthis muralis.</i>	Ivy-leaved wild lettuce, P VII,	-	-	-	I	I	I
122	<i>Scorzonera humilis,</i>	-	-	-	-	I	I	I

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		O.	G.	Sh.	H.	Sw.
123	<i>Tragopogon pratense</i> . Yellow goats-beard, B VI.	-	-	-	-	-
124	<i>Carduus lanceolatus</i> . Spear-thistle, B VII.	-	-	-	-	-
125	— <i>nutans</i> . Mulk-thistle, B VII.	-	-	-	-	-
126	— <i>acaulis</i> . Dwarf caroline thistle, P. VII.	-	-	-	-	-
127	— <i>heterophyllus</i> .	-	-	-	-	-
128	— <i>crispus</i> . Curled-thistle, A VI.	-	-	-	-	-
129	— <i>palustris</i> . Marsh-thistle, P VII.	-	-	-	-	-
130	<i>Solidago virga aurea</i> . Common golden-rod, P. VIII.	-	-	-	-	-
131	<i>Achillea millefolium</i> . Common yarrow, or millfoil, P V. VII. * Tab. XVII.	-	-	-	-	-
132	— <i>ptarmica</i> . Sneezewort, or goose-tongue, P. VIII.	-	-	-	-	-
133	<i>Centaurea scabiosa</i> . Great knapweed, or matfellow, P VI. VII.	-	-	-	-	-
134	— <i>jacea</i> . Common knapweed, or matfellow, P VI. VII.	-	-	-	-	-
135	— <i>cyaneus</i> . Blue-bottles, A VII.	-	-	-	-	-
136	<i>Humulus lupulus</i> . The hop-plant, P VI.	-	-	-	-	-

* The finest pastures I ever saw, those especially on which horses, cattle, and sheep, chiefly delighted to feed, always abounded with this grass.

§ II.

Plants that are eaten by four of the five animals, or rejected only by two of them.

		O.	G.	Sh.	H.	Sw.
137	<i>Scirpus sylvaticus.</i> Millet cyperus-grafs, P VII.	-	-	-	-	-
138	— <i>maritimus.</i> Round rooted bastard cyperus, P VIII.	-	-	-	-	-
139	— <i>lacustris.</i> Bull-rush, P VII. VIII.	-	-	-	-	-
140	— <i>palustris.</i> Club-rush, P VII.	-	-	-	-	-
141	— <i>cæspitosus.</i> Dwarf club-rush, P VII.	-	-	-	-	-
142	<i>Nardus stricta.</i> Matt-grafs, P VI. VII.	-	-	-	-	-
143	<i>Phalaris arundinacea.</i> Reed canary-grafs, P VII.	-	-	-	-	-
144	— <i>phloides.</i>	-	-	-	-	-
145	<i>Phleum pratense.</i> Meadow cat's-tail-grafs, P VII.	-	-	-	-	-
146	<i>Alopecurus pratensis.</i> Meadow fox-tail-grafs, P V.	-	-	-	-	-
147	— <i>geniculatus.</i> Flote fox-tail-grafs, P VI. VIII.	-	-	-	-	-
148	<i>Melica nutans.</i> Melic-grafs, P VI. VII.	-	-	-	-	-
149	— <i>ciliata.</i>	-	-	-	-	-
150	<i>Agrostis spica venti.</i> Silky bent-grafs A VII.	-	-	-	-	-
151	— <i>arundinacea.</i>	-	-	-	-	-
152	— <i>rubra.</i> Red bent-grafs, A VII.	-	-	-	-	-
153	— <i>stolonifera.</i> Creeping bent-grafs, P VIII.	-	-	-	-	-

154	<i>Agrostis tenuifolia.</i>	Fine bent-grass, P VIII. *	-	-	-	O.	G.	Sh.	H.	Sw.
155	— <i>canina.</i>	Brown bent-grass, P VII. VIII.	-	-	-	I	I	n	i	n
156	<i>Gallium verum.</i>	Yellow ladies'-bedstraw, or cheese renning, P VII. VIII.	-	-	-	I	n	n	i	n
157	— <i>mollugo.</i>	Wild madder, or great bastard-madder, P VI. VII.	-	-	-	io	i	i	o	o
158	— <i>borealis.</i>	—	-	-	-	I	I	i	o	i
159	— <i>pulstre.</i>	White ladies'-bedstraw, P VII.	-	-	-	io	i	i	i	o
160	<i>Sherardia arvensis.</i>	Little field madder, A V. VI.	-	-	-	I	o	i	i	o
161	<i>Cornus sanguinea.</i>	Cornel or dog-berry-tree, T VI.	-	-	-	o	i	io	i	n
162	— <i>suecica,</i>	—	-	-	-	o	i	i	i	o
163	<i>Euonymus Europæus.</i>	Spindle-tree, T IV. V.	-	-	-	o	i	i	i	i
164	<i>Alchemilla vulgaris.</i>	Ladies'-mantle, P VI. VIII.	-	-	-	i	i	i	o	n
165	— <i>alpina.</i>	Cinquefoil, ladies'-mantle, P VII.	-	-	-	io	i	i	i	o
166	<i>Cuscuta Europæa.</i>	Dodder, hillweed, or devil's-guts, A VII.	-	-	-	i	i	o	o	o
167	<i>Lycopsis arvensis.</i>	Small wild bugloss, A VI.—IX.	-	-	-	i	oi	i	o	i
168	<i>Convolvulus arvensis.</i>	Small bindweed, P VI. VII.	-	-	-	i	i	i	i	o
169	— <i>spium.</i>	Great bindweed, P VII. VIII.	-	-	-	i	i	i	i	o
170	<i>Polemonium ceruleum.</i>	Great valerian, or Jacob's ladder, P VI.	-	-	-	o	i	i	i	n
			-	-	-	i	i	i	io	n

* Horses, cattle, and sheep, will eat this grass; but they leave it for almost any other fort, and always stay with reluctance on the fields where it abounds.

						O.	G.	Sh.	H.	Sw.
171	<i>Campanula rotundifolia</i> .	Round-leaved bell-flower, P VIII.	-	-	-	i	i	i	i	o
172	— <i>persicifolia</i> .	-	-	-	-	n	i	io	i	n
173	— <i>latifolia</i> .	Giant throatwort, P VII. VIII.	-	-	-	n	i	i	i	n
174	— <i>trachelium</i> .	Canterbury-bells, P VII. VIII.	-	-	-	i	o	n	o	n
175	<i>Ribes rubrum</i> .	Currants, T V.	-	-	-	i	i	i	io	n
176	— <i>nigrum</i> .	Black-currants, T V.	-	-	-	n	i	n	i	n
177	— <i>alpinum</i> .	Sweet mountain-currants, P V.	-	-	-	i	i	i	i	n
178	— <i>uva crispa</i> .	-	-	-	-	o	i	io	i	n
179	<i>Daucus carota</i> .	Wild carrot, or bird's-nest, B VI. VII.	-	-	-	i	i	i	i	n
180	<i>Selinum palustre</i> .	-	-	-	-	i	i	n	i	n
181	— <i>oreoselinum</i> .	-	-	-	-	o	n	i	i	n
182	<i>Ligusticum Scoticum</i> .	Scotch sea-parsley, B VII.	-	-	-	o	i	i	i	n
183	<i>Angelica sylvestris</i> .	Wild angelica, P VI. VII.	-	-	-	i	i	n	o	i
184	— <i>archangelica</i> .	-	-	-	-	i	i	i	o	i
185	<i>Phellandrium aquaticum</i> .	Water-hemloc, B	-	-	-	o	i	i	i	io
186	<i>Cicuta virosa</i> .	Long-leaved water-hemloc, P VII.	-	-	-	o	i	i	i	n
187	<i>Æthusa cynapium</i> .	Fool's-parsley, A VIII. XI.	-	-	-	i	i	i	i	i
188	<i>Scandix anthriscus</i> .	Small hemloc-chervil, with rough seeds, A V. VI.	-	-	-	i	i	i	i	n
189	— <i>cerefolium</i> .	-	-	-	-	i	i	i	i	o

		O.	G.	Sh.	H.	Sw.
206	<i>Trientalis Europæa.</i> Chickweed, winter-green, P VI.	-	-	-	-	-
207	<i>Epilobium angustifolium.</i> Rosebay-willow herb, P VII. VIII.	-	-	-	-	-
208	— <i>hirsutum.</i> Small-flowered hairy willow-herb, P VII.	-	-	-	-	-
209	— <i>montanum.</i> Smooth-leaved willow-herb, B VI.	-	-	-	-	-
210	— <i>palustre.</i> Marsh willow-herb, P VII.	-	-	-	-	-
211	<i>Erica vulgaris.</i> Common heath, or ling, T VI.—VIII.	-	-	-	-	-
212	— <i>tetralix.</i> Cross-leaved heath, T VII. VIII.	-	-	-	-	-
213	<i>Vaccinium uliginosum.</i> The great bilbury bush, T IV. V.	-	-	-	-	-
214	— <i>myrtillus.</i> Black wortleberries, or bilberries, T IV. V.	-	-	-	-	-
215	— <i>vitis idæa.</i> Red wortleberries, T. IV. V.	-	-	-	-	-
216	— <i>oxycoccus.</i> Cranberries, moss or moor-berries, T IV. V.	-	-	-	-	-
217	<i>Polygonum amphibium.</i> Perennial arismet, P VI. VII.	-	-	-	-	-
218	— <i>persicaria.</i> Dead or spotted arismet, A VIII. IX.	-	-	-	-	-
219	— <i>viviparum.</i> Small bistort, or snakeweed, P VI.	-	-	-	-	-
220	— <i>aviculare.</i> Knot-grass, A VI.—IX.	-	-	-	-	-
221	— <i>convolvulus.</i> Black bindweed, A VI.—IX.	-	-	-	-	-
222	— <i>agropyrum.</i> Buck-wheat, or Brank, A VII. VIII.	-	-	-	-	-
223	<i>Dianthus deltoides.</i> Maiden-pinks, P VI. VII.	-	-	-	-	-
224	— <i>arnarius.</i> Stone-pink, P VII.	-	-	-	-	-

		O. G.	Sh.	H. Sw.
242	<i>Lythrum salicaria</i> . Purple-spiked loose strife, or willow-herb, P VII.	I	I	I O
243	<i>Prunus padus</i> . Wild cluster, or bird-cherry, T V.	IO	I	O I
244	— <i>spinos</i> . Black-thorn, or sloe-tree, T III. IV.	n	I	I n n
245	<i>Cratægus aria</i> . White beam-tree, T V.	n	I	I n n
246	— <i>oxycantha</i> . White-thorn, or haw-tree, T V.	I	IO	I n n
247	<i>Spirea filipendula</i> . Dropwort, T VII.	I	I	O I
248	— <i>ulmaria</i> . Meadow-sweet, P. VI. VII.	O	I	O I
249	<i>Tormentilla erecta</i> . Tormentil, or septfoil, P. VI.	I	I	O I
250	<i>Comarum palustre</i> . Purple marsh cinquefoil, P. VI.	IO	I	O O
251	<i>Geum urbanum</i> . Common avens, or herb-bennet, P. VI. VII.	I	I	IO I
252	— <i>riuale</i> . Water-avens, P VII.	O I	I	IO IO
253	<i>Tilia Europea</i> . Lime, or Linden-tree, T VII.	I	I	I n
254	<i>Cistus helianthemum</i> . Dwarf cistus, or little sunflower, P VII.	n	I	I O
255	<i>Lionurus cardiaca</i> . Motherwort, B VII.	O I	I	I O
256	<i>Prunella vulgaris</i> . Self-heal, P. VIII.	I	I	IO n
257	<i>Scutellaria galericulata</i> . Hooded willow-herb, P VII.	I	I	O O
258	<i>Melampyrum cristatum</i> . Crested cow-wheat, A VII.	I	I	O O
259	— <i>arvense</i> . Purple cow-wheat, A VII.	I	I	O n
260	— <i>memorum</i> .	I	I	I I

		O. G.	Sh.	H. Sw.
261	<i>Melampyrum pratense</i> . Meadow cow-wheat, A VII.	-	-	-
262	— <i>sylvaticum</i> . Yellow cow-wheat A VI.—VIII.	-	-	-
263	<i>Euphrasia officinalis</i> . Eyebright, A VIII. IX.	-	-	-
264	— <i>odontites</i> . Red eyebright, A VIII. IX.	-	-	-
265	<i>Draba verna</i> . Common whitlow-grass, A IV.	-	-	-
266	— <i>incana</i> . Wreathen-podded whitlow-grass, B V.	-	-	-
267	<i>Brassica campestris</i> . ——— cabbage,	-	-	-
268	— <i>napus</i> . Wild navew, B V.	-	-	-
269	<i>Sinapis arvensis</i> . Wild mustard, or charlock, A V.	-	-	-
270	<i>Sisymbrium amphibium</i> . Water-radish, P VI.	-	-	-
271	— <i>pinnatifidum</i> ,	-	-	-
272	— <i>sophia</i> . Flixweed, A VII.	-	-	-
273	<i>Erysimum officinale</i> . Hedge mustard, A V.	-	-	-
274	— <i>cheriantoides</i> . Treacle wormseed, A VII.	-	-	-
275	— <i>barbarea</i> . Winter cresses, or rocket, P V.	-	-	-
276	— <i>Alliaria</i> . Jack-by-the-hedge, or fauce alone, P V.	-	-	-
277	<i>Malva rotundifolia</i> . Dwarf-mallow, A VI.—X.	-	-	-
278	— <i>sylvestris</i> . Common mallow, P V.—X.	-	-	-
279	— <i>alea</i> . Vervain mallow, P VII.—IX.	-	-	-

		O.	G.	Sh.	H.	Sw.
280	<i>Malva moschata</i> . Jagged-leaved vervain-mallow, B. VIII.	-	-	-	-	-
281	<i>Leontodon taraxacum</i> . Dandelion, P. IV.—VI.	-	-	-	-	-
282	— <i>autumnale</i> . Yellow devil's-bit, P. VIII.	-	-	-	-	-
283	<i>Hypochaeris maculata</i> . Long-rooted hawkweed, P. V.—VII.	-	-	-	-	-
284	<i>Hieracium alpinum</i> . Mountain hawkweed, P. VII*.	-	-	-	-	-
285	— <i>pilosella</i> . Common creeping mouse-ear, A. V.	-	-	-	-	-
286	— <i>dubium</i> . Mouse-ear hawkweed, P. VII. VIII.	-	-	-	-	-
287	— <i>auriculata</i> . Narrow-leaved hawkweed, P. VII.	-	-	-	-	-
288	— <i>pratensis</i> . — — — — —	-	-	-	-	-
289	— <i>murorum</i> . French, or golden lungwort, P. VII.	-	-	-	-	-
290	— <i>umbellatum</i> . Narrow-leaved bushy hawkweed, P. VII. VIII.	-	-	-	-	-
291	<i>Crepis tetlorum</i> . Smooth succory hawkweed, A. VI.—IX.	-	-	-	-	-
292	<i>Lappula communis</i> . Nipple-wort, A. VI. VII.	-	-	-	-	-
293	<i>Serratula tinctoria</i> . Saw-wort, P. VII.	-	-	-	-	-
294	— <i>alpina</i> . Mountain saw-wort, P. VII.	-	-	-	-	-
295	— <i>arvensis</i> . Corn saw-wort, or way-thistle, P. VII.	-	-	-	-	-
296	<i>Tussilago farfara</i> . Common colt's-foot, P. III.	-	-	-	-	-

* I have remarked, that sheep are extremely fond of all the plants of this class, as well as the leontodons.

335	<i>Mercurialis perennis.</i>	Dog's-mercury, P IV. V.	-	-	-	O	I	I	n	n	H. Sw.
336	<i>Juniperus communis.</i>	Common juniper, T V.	-	-	-	a	I	I	n	n	
337	<i>Atriplex laciniata.</i>	Jagged sea-orache, A VIII.	-	-	-	I	n	n	n	n	
338	— <i>biflata.</i>	Wild-orache, A VIII. IX.	-	-	-	I	n	n	n	n	
339	— <i>pátula.</i>	Narrow-leaved orache, A VIII.	-	-	-	I	I	I	n	n	
340	— <i>portulacoides.</i>	Sea-purslain, T VIII.	-	-	-	I	I	I	I	O	
341	<i>Fraxinus excelsior.</i>	Common ash-tree, T III. IV.	-	-	-	I	I	I	I	O	
342	<i>Equisetum arvense.</i>	Corn horse-tail, P, III.	-	-	-	O	I	O	n	n	
343	— <i>sylvaticum.</i>	Wood horse-tail, P IV. V.	-	-	-	n	I	n	n	n	
344	— <i>palustre.</i>	Marsh horse-tail, P VI.	-	-	-	n	I	n	n	n	
345	— <i>fluvatile.</i>	River horse-tail, P V.	-	-	-	IO	I	I	I	I	
346	— <i>hyemale.</i>	Rough horse-tail, or shave-grass, P VII. VIII.	-	-	-	O	I	O	n	IO	

§ III.

<i>Plants that were eaten by three of the five animals, or only rejected by three of them.</i>											
347	<i>Ligustrum vulgare.</i>	Privet, or prim, T V.	-	-	-	I	I	I	O	O	
348	<i>Veronica maritima,</i>	—	-	-	-	I	I	I	O	O	
349	— <i>spicata.</i>	Upright-spiked male speedwell, or Newellin, P VI.	-	-	-	I	O	I	O	n	
350	— <i>anagallis.</i>	Long-leaved water speedwell, P VII.	-	-	-	I	I	I	O	O	

III.

Plants that were eaten by three of the five animals, or only rejected by three of them.

347	<i>Ligustrum vulgare.</i>	Privet, or privet, T V.	-	-	-	I	I	I	O	O
348	<i>Veronica maritima,</i>	-	-	-	-	I	I	I	O	O
349	----- <i>spicata.</i>	Upright-spiked male speedwell, or flewellin, P VI.	-	-	-	I	O	I	O	n
350	----- <i>anagallis.</i>	Long-leaved water speedwell, PVII.	-	-	-	I	I	I	O	O

368	<i>Primula vulgaris.</i>	Common primrose, P IV. V.	-	-	O.	G.	Sh.	H.	Sw.
369	— <i>farinosa.</i>	Bird's-eye, P V.	-	-	O	I	I	O	O
370	<i>Samolus valerandi.</i>	Round-leaved water-pimpernel, P VI.	-	-	O	I	I	I	n
371	<i>Lysimachia vulgaris.</i>	Yellow willow-herb, or loofefrife, P VI. VII.	-	-	I	I	I	O	n
372	— <i>thyriflora.</i>	Tufted loofefrife, P VI.	-	-	I	I	IO	O	O
373	— <i>nummularia.</i>	Moneywort, P VI.	-	-	O	I	IO	O	O
374	<i>Lonicera periclymenum.</i>	Common honeysuckle or woodbine, T V. VI.	-	-	I	IO	I	O	n
375	— <i>xylifeum,</i>	-	-	-	I	I	I	O	n
376	<i>Rhamnus catharticus.</i>	Buckthorn, T IV. V.	-	-	O	I	I	I	n
377	— <i>frangula.</i>	Blackberry-bearing aldar, T IV. V.	-	-	O	I	I	I	n
378	<i>Herniaria glabra.</i>	Smooth rupture-wort, A VII.	-	-	I	O	I	I	O
379	<i>Chenopodium hnericus.</i>	Common Engliffh mercury, or allgood, P VIII.	-	-	O	IO	IO	O	O
380	— <i>urbicum.</i>	Upright blite, A VIII. IX.	-	-	O	I	I	O	n
381	— <i>rubrum.</i>	Sharp leaved goofe-foot, A VIII.	-	-	I	I	I	O	I
382	— <i>murale.</i>	Common goofe-foot, or fowbane, A VIII.	-	-	I	n	n	n	n
383	— <i>album.</i>	Common orache, A VIII.	-	-	I	I	I	O	I
384	— <i>hybridum.</i>	Mapple-leaved blite, A VIII.	-	-	I	O	I	O	O
385	— <i>viride.</i>	Green blite, A	-	-	n	I	I	n	I
386	— <i>glaucum.</i>	Oak-leaved blite, A VIII.	-	-	I	n	n	I	I

		O.	G.	Sh.	H.	Sw.
387	<i>Chenopodium vulvaria</i> . Stinking orache, A VIII.	-	-	-	-	-
388	— <i>polypermum</i> . Round-leaved blite, or all-seed, A	-	-	-	-	-
389	<i>Athamanta libanotis</i> . Mountain stone-parley, P VIII. IX.	-	-	-	-	-
390	<i>Sium latifolium</i> . Great water-parfnip, P VII. VIII.	-	-	-	-	-
391	<i>Parnassia vulgaris</i> . Grafs of Parnassus, P VIII.	-	-	-	-	-
392	<i>Statice armeria</i> . Thrift, sea-gillyflower, P VII. VIII.	-	-	-	-	-
393	— <i>limonium</i> . Sea-lavender, P VII. VIII.	-	-	-	-	-
394	<i>Allium ursinum</i> . Ramfon, P V.	-	-	-	-	-
395	— <i>scorodoprasum</i> .	-	-	-	-	-
396	— <i>oleraceum</i> . Wild garlic, P VII.	-	-	-	-	-
397	<i>Asparagus officinalis</i> . Sparagus or sperage, P VII. VIII.	-	-	-	-	-
398	<i>Convallaria majalis</i> . Cornwall-lily, or May-lily, P V.	-	-	-	-	-
399	— <i>multiflora</i> . Solomon's seal, P V. VI.	-	-	-	-	-
400	— <i>polygonatum</i> . Sweet-smelling Solomon's seal, P V.	-	-	-	-	-
401	<i>Berberis vulgaris</i> . Barberry, or peperidge-bush, T	-	-	-	-	-
402	<i>Acer platanoides</i> . Maple-tree, T	-	-	-	-	-
403	<i>Papaver dubium</i> . Long smooth-headed poppy, A VI. VII.	-	-	-	-	-
404	— <i>rheas</i> . Red corn-poppy, A VII. VIII.	-	-	-	-	-
405	<i>Euphorbia helioscopia</i> . Sunspurge, or wartwort, A VII.	-	-	-	-	-

					O.	G.	Sh.	H.	Sw.
425	<i>Cardamine amara.</i>	Bitter cresses, or ladies'-smoke, P IV. V.	-	-	IO	n	I	n	n
426	<i>Fumaria officinalis.</i>	Fumitory, A IV.—VI.	-	-	I	IO	I	O	O
427	— <i>bulbosa,</i>	-	-	-	IO	I	n	n	n
428	<i>Hypericum quadrangulare.</i>	St. Peter's wort, P VII.	-	-	I	I	I	O	O
429	— <i>perforatum.</i>	St. John's wort, P VII.	-	-	I	I	I	O	O
430	— <i>hirsutum.</i>	Tuscan, or hairy St. John's-wort, P VII.	-	-	n	n	I	O	n
431	<i>Chicorium intybus.</i>	Wild succory, B VII. VIII.	-	-	O	I	I	O	I
432	<i>Arctium lappa.</i>	Burdock, or clot-bur, B VII. VIII.	-	-	I	I	O	O	O
433	<i>Artemisia vulgaris.</i>	Mugwort, P VIII.*	-	-	IO	IO	O	IO	O
434	— <i>campestris.</i>	Field southernwood, P VIII.	-	-	n	O	O	n	n
435	— <i>rupestris,</i>	-	-	-	I	O	I	I	n
436	— <i>absinthium.</i>	Common wormwood, P VIII.	-	-	O	IO	I	IO	O
437	— <i>maritima.</i>	Sea wormwood, P VIII.	-	-	O	O	O	I	n
438	<i>Gnaphalium dioicum.</i>	Mountain cud-weed, or cats-foot, P V.	-	-	O	O	I	I	I
439	— <i>stivaticum.</i>	Upright cud-weed, B VIII.	-	-	n	I	n	n	n
440	— <i>uliginosum.</i>	Black-headed cud-weed, A VIII.	-	-	O	O	n	n	n
441	<i>Senecio vulgaris.</i>	Common groundsel, or Simpson, A V.	-	-	IO	I	O	O	I

* *Artemisia vulgaris*.—Sheep certainly eat the leaves of this plant when young, and are uncommonly fond of its roots.

		O.	G.	Sh.	H.	Sw.
442	<i>Senecio jacobaea</i> .	Common ragwort, P VII. *	IO	n	O	n
443	<i>Inula pulicaria</i> .	Small fleabane, A VIII. IX.	O	O	I	O
444	— <i>dyssenterica</i> .	Middle fleabane, P VIII.	O	O	O	n
445	— <i>helenium</i> .	Elecampane, P VII. VIII.	O	I	O	O
446	— <i>salicina</i> ,	—	I	I	I	n
447	<i>Aster tripolium</i> .	Sea starwort, P VIII.	O	I	IO	O
448	<i>Chrysanthemum leucanthemum</i> .	Greater daisy, ox-eye, P V.	O	I	I	O
449	<i>Anthemis cotula</i> .	Stinking May-weed, A VI. VII.	O	O	I	O
450	— <i>arvensis</i> .	Corn-camomile, B VII.	I	n	I	O
451	— <i>tinctoria</i> .	Common ox-eye, P VII.	O	I	O	I
452	<i>Cnicus eleraceus</i> ,	—	O	I	O	I
453	<i>Calendula officinalis</i> .	Garden-marygold,	I	IO	I	O
454	<i>Zostera marina</i> .	Grass-wrack, P	O	I	n	I
455	<i>Sparganium erectum</i> .	Great bur-reed, P VII.	O	I	O	I
456	— <i>natans</i> .	The least bur-reed, P VII.	O	I	n	I
457	<i>Sagittaria sagittifolia</i> .	Arrow-head, P VI.	I	n	n	n
458	<i>Lycopus Europæus</i> .	Water horehound, P VII.	IO	I	n	I
459	<i>Salvia pratensis</i> .	Meadow-clary, P	O	I	I	O

* *Senecio jacobaea*—Sheep likewise eat this plant greedily when young—Cattle seldom taste it.

		O.	G.	Sh.	H.	Sw.
477	<i>Anthericum ranunculifolium</i> ,	-	-	-	-	-
478	— <i>calyculatum</i> . Scottish asphodel, P IX.	-	-	-	-	-
479	— <i>offisfragum</i> ,	-	-	-	-	-
480	<i>Rumex aquaticus</i> ,	-	-	-	-	-
481	— <i>crispus</i> . Curled dock, P VI. VII.	-	-	-	-	-
482	— <i>acutus</i> . Sharp-pointed dock, P. VI. *	-	-	-	-	-
483	— <i>digynus</i> . Round-leaved mountain sorrel, P VI.	-	-	-	-	-
484	<i>Daphne mezereum</i> . Mezercon-trees, T II.	-	-	-	-	-
485	<i>Paris quadrifolia</i> . Herb Paris, true love, or one-berry, P V. VI.	-	-	-	-	-
486	<i>Andromeda polifolia</i> . Marsh cistus, or wild rosemary, P III. IV.	-	-	-	-	-
487	— <i>cerulea</i> ,	-	-	-	-	-
488	— <i>hymnoides</i> ,	-	-	-	-	-
489	<i>Scleranthus annuus</i> . German knot-grass, or annual knawel, A VIII.	-	-	-	-	-
490	<i>Cerastium viscosum</i> . Broad-leaved mouse-ear chickweed, A IV. V.	-	-	-	-	-
491	— <i>alpinum</i> . Mountain mouse-ear chickweed, P VI.	-	-	-	-	-
492	— <i>eupatoria</i> . Agrimony, P VI.	-	-	-	-	-
493	<i>Sempervivum tetlorum</i> . Houseleek, P VII.	-	-	-	-	-

* Dock.—Cattle seldom reject this plant, when it is cut and given them by the hand. They never taste it when growing in the field.

		O.	G.	Sh.	H.	Sw.
494	<i>Nymphæa lutea.</i>					
495	— <i>alba.</i>	o	e	o	o	i
496	<i>Agæa spicata.</i>	o	o	n	o	i
497	<i>Aconitum lycoctenium,</i>	o	i	i	o	o
498	<i>Aquilegia vulgaris.</i>	o	i	o	o	n
499	<i>Anemone hepatica,</i>	o	i	o	o	o
500	— <i>pulsatilla.</i>	o	o	i	o	o
501	— <i>pratensis,</i>	o	i	o	o	o
502	— <i>nemorosa.</i>	n	n	n	o	n
503	— <i>verna,</i>	o	i	i	o	o
504	<i>Ranunculus flammula.</i>	n	n	n	o	n
505	— <i>ficaria,</i>	o	o	o	i	o
506	— <i>auricomus.</i>	o	i	o	o	n
507	— <i>sceleratus.</i>	o	i	o	o	n
508	— <i>acris.</i>	o	i	o	o	n
509	— <i>repens.</i>	o	i	o	o	n
510	— <i>bulbosus.</i>	n	n	n	o	n
511	<i>Caltha palustris.</i>	o	i	i	o	o
512	<i>Teucrium scordium.</i>	o	i	i	o	o

494 *Nymphæa lutea.* Yellow-water lily, P VIII.

495 — *alba.* White-water lily, P VII.

496 *Agæa spicata.* Herb Christopher, or bane-berries, P V. VI.

497 *Aconitum lycoctenium,*

498 *Aquilegia vulgaris.* Common columbine, P VI.

499 *Anemone hepatica,*

500 — *pulsatilla.* Pasque flower, P IV.

501 — *pratensis,*

502 — *nemorosa.* Common wood anemone, P IV.

503 — *verna,*

504 *Ranunculus flammula.* Lesser spiderwort, P VI.—IX.

505 — *ficaria,*

506 — *auricomus.* Sweet-wood crowfoot, or goldlocks, P IV.

507 — *sceleratus.* Round-leaved water crowfoot, A V. VI.

508 — *acris.* Upright meadow crowfoot, P. VI. VII.

509 — *repens.* Creeping crowfoot, or butter-cups, P. V.

510 — *bulbosus.* Bulbous crowfoot, or butter-cups, P V.

511 *Caltha palustris.* Marsh marygold, P IV.

512 *Teucrium scordium.* Water Germander, P VIII.

513	<i>Thymus serpyllum.</i>	Mother of thyme, P VII. VIII.	O.	G.	Sh.	H.	Sw.
514	— <i>acinos.</i>	Wild basil, A VII. VIII.	n	i	i	n	o
515	<i>Clinopodium vulgare.</i>	Great wild basil, P VIII.	io	o	o	i	n
516	<i>Glechoma hederacea.</i>	Ground-ivy, P V.	n	i	i	o	n
517	<i>Stachys sylvatica.</i>	Hedge-nettle, P VII. VIII.	o	o	i	io	o
518	— <i>palustris.</i>	Clown's all-heal, P VIII.	o	i	i	o	o
519	<i>Lamium album.</i>	White dead nettle, or archangel, P V.	o	o	i	o	o
520	— <i>purpureum.</i>	Red archangel, or dead nettle, A V.	io	i	i	o	o
521	— <i>amplexicaule.</i>	Great hen-bit, A VI.	o	i	i	i	n
522	<i>Pedicularis sylvatica.</i>	Common louse-wort, P V. VI.	n	i	i	i	n
523	— <i>palustris.</i>	Marsh louse-wort, VI.	o	n	n	n	o
524	— <i>sceptrum carolin,</i>		o	i	o	o	oi
525	— <i>lappontica,</i>		i	i	n	o	n
526	<i>Barbisa alpina.</i>	Mountain eyebright cow wheat, P VII.	n	i	i	n	n
527	<i>Linnaea borealis,</i>		n	i	i	n	n
528	<i>Bidens tripartitus.</i>	Trifid water-hemp agrimony, A VIII. IX.	o	i	i	o	o
529	— <i>cernuis.</i>	Whole-leaved water-hemp agrimony, A VII. VIII.	i	o	i	o	o
530	<i>Tanacetum vulgare.</i>	Common tansy, P. VII.	n	i	n	o	n
531	<i>Orchis maris.</i>	Female fool-stones, or orchis, P V. VI.	i	o	p	o	o
			n	i	n	o	n

		O.	G.	Sh.	H.	Sw.
532	<i>Orchis conopsea</i> : Red-handed orchis, B VI.	I	I	n	n	n
533	— <i>latifolia</i> . Male-handed orchis, P V. VI.	I	n	n	n	n
534	— <i>maculata</i> . Female-handed orchis, P VI.	IO	O	I	O	n
535	<i>Ophrys ovata</i> . Common tway-blade, P V. VI.	I	I	n	n	n
536	<i>Xanthium strumarium</i> . Lesser-burdock, A VIII. IX.	O	I	O	I	O
537	<i>Pinus sylvestris</i> . Scottish fir, T V.	n	IO	O	I	O
538	— <i>abies</i> . Common pitch fir, T	n	I	O	n	n
539	<i>Myrica gale</i> . Gale, or sweet-willow, T	e	I	O	I	n
540	<i>Taxus baccata</i> . Yew-tree, T	O	I	I	O	n
541	<i>Rhodiola rosea</i> . Rosewort, P VI. VII.	O	I	I	I	n
542	<i>Polypodium vulgare</i> . Common polypody, P	n	O	I	O	n
543	— <i>flax mas</i> . Male polypody, or fern, P	IO	I	O	n	n
544	— <i>fragile</i> . Brittle polypody, P	I	O	I	O	n
545	<i>Carlina vulgaris</i> . Wild carline thistle, B VI.	O	I	n	n	n

§ IV.

Plants that were eaten by two of the five animals, or rejected by four of them.

546	<i>Salicornia Europea</i> . Marsh-samphire, jointed-glasswort, or saltwort, A VIII. IX.	O	n	O	O	I
547	<i>Hippuris vulgaris</i> . Mares'-tail, P V.	O	I	O	O	O

		O.	G.	Sh.	H. Sw.
548	<i>Circea luteoliana alpina</i> . Enchanters' nightshade, P VI. VII.	-	-	-	-
549	<i>Verbena officinalis</i> . Vervain, P VI. VII.	-	-	-	-
550	<i>Iris pseudacorus</i> . Yellow-water flower-de-luce, P VII.	-	-	-	-
551	<i>Schoenus albus</i> . White-flowered rush-grass, P VII.	-	-	-	-
552	<i>Sagina procumbens</i> . Pearlwort, or chickweed breakstone, A VI.	-	-	-	-
553	<i>Myosotis palustris</i> . Water-violet, P VII. VIII.	-	-	-	-
554	<i>Hottonia palustris</i> . Common henbane, A VI.	-	-	-	-
555	<i>Hyoscyamus niger</i> . Sea-milkwort, or black-saltwort, P VII.	-	-	-	-
556	<i>Glaux maritima</i> . Sea-milkwort, or black-saltwort, P VII.	-	-	-	-
557	<i>Aclepias vincetoxicum</i> . Autumnal-gentian, or fellwort, A VII. VIII.	-	-	-	-
558	<i>Gentiana amarella</i> . Lesser centory, A VI.—VIII.	-	-	-	-
559	— <i>centaurium</i> . Hedge-parley, B VIII.	-	-	-	-
560	<i>Tordylium anthriscus</i> . Hemloc, A VI. VII.	-	-	-	-
561	<i>Conium maculatum</i> . Water-dropwort, P VII.	-	-	-	-
562	<i>Ænanthe fistulosa</i> . Common elder, T V. VI.	-	-	-	-
563	— <i>crocata</i> . The tulip, P VI.	-	-	-	-
564	<i>Sambucus nigra</i> . Great water-plantain, P VI.	-	-	-	-
565	<i>Tulipa sylvestris</i> .	-	-	-	-
566	<i>Alliina plantago</i> .	-	-	-	-

		O.	G.	Sh.	H.	Sw.
567	<i>Chrysosplenium alternifolium.</i>	-	-	-	-	-
568	<i>Adoxa moschatellina.</i>	-	-	-	-	-
569	<i>Pyrola rotundifolia.</i>	-	-	-	-	-
570	<i>secunda.</i>	-	-	-	-	-
571	<i>uniflora.</i>	-	-	-	-	-
572	<i>Ledum palustre.</i>	-	-	-	-	-
573	<i>Saponaria fastigiata.</i>	-	-	-	-	-
574	<i>Saxifraga granulata.</i>	-	-	-	-	-
575	<i>Arenaria serpyllifolia.</i>	-	-	-	-	-
576	<i>trinervia.</i>	-	-	-	-	-
577	<i>peplodes.</i>	-	-	-	-	-
578	<i>rubra.</i>	-	-	-	-	-
579	<i>Afarum Europæa.</i>	-	-	-	-	-
580	<i>Stratiotes aloides.</i>	-	-	-	-	-
581	<i>Nepeta cataria.</i>	-	-	-	-	-
582	<i>Betonica officinalis.</i>	-	-	-	-	-
583	<i>Scrophularia nodosa.</i>	-	-	-	-	-
584	<i>Cochlearia officinalis.</i>	-	-	-	-	-
585	<i>Danica.</i>	-	-	-	-	-

567 *Chrysosplenium alternifolium.* Alternate-leaved golden saxifrage, P IV.

568 *Adoxa moschatellina.* Tuberoses moschatel, P III. IV.

569 *Pyrola rotundifolia.* Common winter-green, P VI. VII.

570 *secunda.* Dented-leaved winter-green, P VI.

571 *uniflora.*

572 *Ledum palustre.* Marsh-cistus, or wild rosemary,

573 *Saponaria fastigiata.*

574 *Saxifraga granulata.* White fingleen, or saxifrage, P V.

575 *Arenaria serpyllifolia.* The least chickweed, A V.

576 *trinervia.* Plantain-leaved chickweed, A V.

577 *peplodes.* Sea-chickweed, P VI. VII.

578 *rubra.* Purple-flowered chickweed, or sea-spurry, A VI.

579 *Afarum Europæa.* Asarabacca, P V.

580 *Stratiotes aloides.* Water-aloë, or fresh-water soldier, P VI.

581 *Nepeta cataria.* Nap, or cat-mint, P VII.

582 *Betonica officinalis.* Wood betony, P VII. VIII.

583 *Scrophularia nodosa.* Knobby-rooted figwort, P VII.

584 *Cochlearia officinalis.* Common, or garden scurvy-grass, B IV. V.

585 *Danica.* Danish scurvy-grass,

		O.	G.	Sh.	H.	Sw.
586	<i>Isatis tinctoria.</i> Woad, B VI.	-	-	-	-	-
587	<i>Arabis thaliana.</i> Coded mouse-ear, A V.	-	-	-	-	-
588	<i>Raphanus raphanistrum.</i> Wild charlock *.	-	-	-	-	-
589	<i>Bunias cakile.</i> Sea-rocket, A VI.	-	-	-	-	-
590	<i>Eupatorium cannabinum.</i> Hemp-agrimony, or Dutch ditto, P VII. VIII.	-	-	-	-	-
591	<i>Filago pyramidalis,</i>	-	-	-	-	-
592	— <i>montana.</i> The least cudweed, A VI. VII.	-	-	-	-	-
593	— <i>arvensis,</i>	-	-	-	-	-
594	<i>Erigeron acris.</i> Blue-flowered fleabane, P VII. VIII.	-	-	-	-	-
595	— <i>uniflorum,</i>	-	-	-	-	-
596	<i>Impatiens noli me tangere.</i> Quick in the hand, touch me not, A VIII.	-	-	-	-	-
597	<i>Satyrion viride.</i> Frog satyrion, or orchis, P V. VI.	-	-	-	-	-
598	— <i>nigrum,</i>	-	-	-	-	-

* *Raphanus.*—Cattle certainly eat this when green, if cut and given by the hand; they also eat it while growing. Sheep so readily eat it while growing, that some farmers formerly used to turn their sheep among their turnips, to get it destroyed without hoeing:—if sheep have never before tasted turnips, they prefer the charlock to them; but if sheep have been accustomed to turnips before, they devour them with greediness, in preference to almost any other plant.

	O.	G.	Sh.	H.	Sw.
599 <i>Cypripedium calceolus</i> . Ladies'-slipper, P VII.	n	i	n	n	n
600 <i>Typha angustifolia</i> . Narrow-leaved cat's-tail, P VII.	i	n	n	n	o
601 <i>Bryonia alba</i> . White-bryony, P V.	o	i	o	o	o
602 <i>Corylus avellana</i> . The hazel-tree, T I. II.	n	i	o	n	o
603 <i>Empetrum nigrum</i> . Black-berried heath, crow, or crack-berries, P IV. V.	o	io	o	o	n

§ V.

Plants that were not eaten by any of the five animals at all.

604 <i>Pinguicula vulgaris</i> . Butterwort, or Yorkshire fanicle, P V.*	o	o	o	o	o
605 — <i>alpina</i> .	o	o	o	o	o
606 — <i>villosa</i> .	o	o	o	o	o
607 <i>Montia fontana</i> . Water-chickweed, A IV.	o	n	o	o	o
608 <i>Potamogeton perfoliatum</i> . Perfoliated pond-weed, P VI. VII.	o	o	o	o	o
609 — <i>lucens</i> . Long-leaved pond-weed, P VI.	o	n	o	o	o
610 — <i>crispum</i> . Greater water-caltrops, P V. VI.	o	n	n	n	n
611 — <i>pectinatum</i> . Fennel-leaved pond-weed, P VI.	n	o	n	n	n

* *Pinguicula*.—This is the plant called by the vulgar, *rot-grass*—it is commonly imagined that sheep eat it greedily, and that it occasions the rot in them. I never saw it touched by any animal.

612	<i>Myofotis scorpioides</i> .	Mouſe-ear ſcorpion-grafs, P IV.—VIII.	-	-	O.	G.	Sh.	H.	Sw.
613	— <i>lappula</i> ,	-	-	-	O	O	O	O	O
614	<i>Diapenſia lapponica</i> ,	-	-	-	O	n	O	O	n
615	<i>Datura ſtramonium</i> .	Thorny-apple, A VII.	-	-	O	O	O	O	n
616	<i>Verbafcum thapſus</i> .	Great white mullein, high-taper, or cows lungwort, B VII.	-	-	O	O	O	O	O
617	— <i>lychnitis</i> .	Hoary-mullein, B VII.	-	-	O	O	O	O	O
618	<i>Solanum nigrum</i> .	Garden-nightſhade, A VI. VII.	-	-	O	O	O	O	O
619	<i>Salſola kali</i> .	Prickly-graſſwort, A VII. VIII.	-	-	O	O	O	O	O
620	<i>Sambucus ebulus</i> .	Dwarf-elder, walwort, danewort, T VII.	-	-	O	O	O	O	O
621	<i>Acorus calamus</i> .	Sweet-smelling flag, or calamus aromaticus, P V.	-	-	O	O	O	O	O
622	<i>Polygonum hydropiper</i> .	Water-pepper, or arſmart, A VII. VIII.	-	-	O	O	O	O	O
623	<i>Butomus umbellatus</i> .	Flowering-ruſh, or water gladiole, P VI.	-	-	O	O	O	O	O
624	<i>Dryas octopetala</i> .	Mountain-avens, P VII.	-	-	O	O	O	O	O
625	<i>Aconitum nappellus</i> ,	-	-	-	O	O	O	O	O
626	<i>Ranunculus aquatilis</i> .	Various-leaved water-crowfoot, P IV. V.	-	-	O	O	O	O	O
627	<i>Ballota nigra</i> .	Stinking-horehound, A VII.	-	-	O	O	O	O	n
628	<i>Marrubium vulgare</i> .	White-horehound, P VII.	-	-	O	O	O	O	n
629	<i>Cochlearia armorica</i> .	Horſe-raddiſh, P V.	-	-	O	O	O	O	O
630	<i>Dentaria bulbifera</i> .	Coralwort, P IV.	-	-	n	n	n	n	O

					O.	G.	Sh.	H.	Sw.
631	<i>Spartium scoparium.</i>	Common broom	T V. VI.*	-	-	-	-	-	-
632	<i>Onopordum acanthium.</i>	Cotton-thistle,	B VII.	-	-	-	-	-	-
633	<i>Bellis perennis.</i>	Common daisy,	P III.—IX.†	-	-	-	-	-	-
634	<i>Calla palustris,</i>	-	-	-	-	-	-	-	-
635	<i>Myriophyllum spicatum.</i>	Spiked water-milfoil,	P VI. VII.	-	-	-	-	-	-
636	<i>Asplenium trichomanes.</i>	Common maiden-hair,	P	-	-	-	-	-	-
637	<i>Acrostichum septentrionale.</i>	Forked, or horned-fern,	P	-	-	-	-	-	-
638	<i>Chelidonium majus.</i>	-	-	-	-	-	-	-	-

* Broom.—Sheep sometimes eat this in winter;—but they are greedy of the blossom, which they pick off with care.—They also eat the young pods.

† Daisy.—It is commonly imagined, that a field in which this plant abounds, affords fine pasture; which proceeds from inaccurate observation.—The flowers are not touched, and appear beautiful, the leaves remain uncroft and appear luxuriant, without the appearance of rankness, while the other more valuable grasses are bitten close to the ground.—I believe no animal eats this through choice, but as it is small, and closely mixed with other palatable plants, it is sometimes croft through necessity among them.

APPENDIX.

445

From the foregoing Table, it appears,

	Eat	Refuse	Total
That Goats	470	75	545
Sheep	422	111	583
Oxen	328	187	515
Horses	293	209	502
Swine	119	180	305
			2400

APPENDIX

2nd	10	180	302	100
1st	20	200	235	100
3rd	30	190	212	100
4th	40	140	213	100
5th	50	120	213	100
6th	60	100	213	100
7th	70	80	213	100
8th	80	60	213	100
9th	90	40	213	100
10th	100	20	213	100
11th	110	10	213	100
12th	120	0	213	100
13th	130	0	213	100
14th	140	0	213	100
15th	150	0	213	100
16th	160	0	213	100
17th	170	0	213	100
18th	180	0	213	100
19th	190	0	213	100
20th	200	0	213	100
21st	210	0	213	100
22nd	220	0	213	100
23rd	230	0	213	100
24th	240	0	213	100
25th	250	0	213	100
26th	260	0	213	100
27th	270	0	213	100
28th	280	0	213	100
29th	290	0	213	100
30th	300	0	213	100
31st	310	0	213	100
32nd	320	0	213	100
33rd	330	0	213	100
34th	340	0	213	100
35th	350	0	213	100
36th	360	0	213	100
37th	370	0	213	100
38th	380	0	213	100
39th	390	0	213	100
40th	400	0	213	100
41st	410	0	213	100
42nd	420	0	213	100
43rd	430	0	213	100
44th	440	0	213	100
45th	450	0	213	100
46th	460	0	213	100
47th	470	0	213	100
48th	480	0	213	100
49th	490	0	213	100
50th	500	0	213	100
51st	510	0	213	100
52nd	520	0	213	100
53rd	530	0	213	100
54th	540	0	213	100
55th	550	0	213	100
56th	560	0	213	100
57th	570	0	213	100
58th	580	0	213	100
59th	590	0	213	100
60th	600	0	213	100
61st	610	0	213	100
62nd	620	0	213	100
63rd	630	0	213	100
64th	640	0	213	100
65th	650	0	213	100
66th	660	0	213	100
67th	670	0	213	100
68th	680	0	213	100
69th	690	0	213	100
70th	700	0	213	100
71st	710	0	213	100
72nd	720	0	213	100
73rd	730	0	213	100
74th	740	0	213	100
75th	750	0	213	100
76th	760	0	213	100
77th	770	0	213	100
78th	780	0	213	100
79th	790	0	213	100
80th	800	0	213	100
81st	810	0	213	100
82nd	820	0	213	100
83rd	830	0	213	100
84th	840	0	213	100
85th	850	0	213	100
86th	860	0	213	100
87th	870	0	213	100
88th	880	0	213	100
89th	890	0	213	100
90th	900	0	213	100
91st	910	0	213	100
92nd	920	0	213	100
93rd	930	0	213	100
94th	940	0	213	100
95th	950	0	213	100
96th	960	0	213	100
97th	970	0	213	100
98th	980	0	213	100
99th	990	0	213	100
100th	1000	0	213	100

THE END OF THE WORLD

INDEX NOMINUM LATINORUM.

[N.B. The Figures refer to the Numbers in the foregoing Table.]

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DR. ANDERSON thinks himself unfortunate in having occasion to complain of such repeated acts of injustice done to him by Sir John Sinclair. He should not, however, have troubled the public in consequence of this injury he is now about to state, had it respected himself alone; but as it tends to affect the memory of a man to whom he lies under the greatest obligations, and for whose memory he bears the most respectful veneration, no consideration whatever can prevail with him to become as it were a silent accomplice to a deed which tends to wound his reputation in the most insidious manner. These considerations induced him to publish the following advertisement in the Morning Chronicle, for March 25th last; to which he has not as yet seen any answer. He now reprints it, to give it the greater degree of publicity, till he should more deliberately determine what farther steps will be necessary completely to effect the purpose of rescuing the memory of Dr. Cullen from the injury it has thus sustained.

ADVERTISEMENT.

"WE are authorised by Dr. Anderson, to inform the public, that a paper which has been printed and circulated by the Board of Agriculture, purporting to be written by the late Dr. Cullen, of Edinburgh, and commented upon as a genuine performance of that eminent man, is not a work of Dr. Cullen, who never wrote or corrected one syllable of it; that every word of that paper was written by Dr. James Anderson, being the substance of very imperfect notes taken by him, while yet a boy of little more than fifteen years of age, from the extempore discourses of Dr. Cullen, which was his first attempt to take notes of any kind. Conscious of the extreme inaccuracy of these notes, the pupil took care not only to mark this particular in the very title, by the words, "*errores sunt discipuli*," but also to state it more clearly in a short advertisement prefixed (all of which have been suppressed in the printed copy) warning every person into whose hands it might fall, not to suffer the errors of the pupil to injure the character of the preceptor; but he farther took care never since to allow the MS. to be out of his possession, unless to two of Dr. Cullen's sons alone, to whom he lent it under the strictest injunctions, not to allow it to be seen or copied by any person whatever. Sir John Sinclair having heard that this MS. was in the possession of Mr. Cullen (now Lord Cullen) applied to that gentleman, through various channels, for permission to take a copy of it, which he positively refused to do, or to give his consent to its being published, could a copy of it be even obtained. Sir John afterwards, however, found means (which it is supposed he does not desire to have publicly developed) to obtain a copy of that MS. and immediately published it, to the no small astonishment of Mr. Cullen, as well as to that of the owner of the MS. No sooner did Dr. Anderson see a copy of that publication, and came to an explanation with Mr. Cullen on the subject, than he stated his claim to the MS. in a letter to Sir John Sinclair, and soon after to the Board of Agriculture also, requiring that a farther publication of it might be stopped, as being his own private property; and also, with a view to do justice to the character of Dr. Cullen, requested that the Board would be pleased to make some public intimation of the mistake it had inadvertently fallen into in ascribing it to him. This the Board at last declined to do, in consequence of which this short statement of facts is made public, in the mean time, till more effectual means for obtaining redress be adopted.



J. Elliot Mount Swift

1609/5791.

E S S A Y S

RELATING TO

A G R I C U L T U R E

AND

R U R A L A F F A I R S.

V O L. III.

ESTABLISHED

OF DISTANCE

AGRICULTURE

AND

RURAL AFFAIRS

VOL. III.

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E S S A Y S.

RELATING TO

A G R I C U L T U R E

AND

R U R A L A F F A I R S.

BY

JAMES ANDERSON, LL.D.

F R S. F A S. S.

Honorary Member of the Society of Arts, Agriculture, &c. at Bath; of the Philosophical, and of the Agricultural Societies in Manchester; of the Society for promoting Natural History, London; of the Academy of Arts, Sciences, and Belles Lettres, Dijon; of the Philosophical Society, Philadelphia; of the Royal Economical Society, Berlin; and correspondent Member of the Royal Society of Agriculture, Paris; Author of several Performances.

VOLUME THIRD.

And he gave it for his opinion, that whoever could make two ears of corn or two blades of grass, to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of Politicians put together. SWIFT.

EDINBURGH:

PRINTED FOR BELL & BRADFUTE, PARLIAMENT-SQUARE;

& FOR THE ROBINSONS, PATER-NOSTER-ROW, LONDON.

M,DCC,XCVI.



TO
GEORGE DEMPSTER, ESQ.

WHOSE EXERTIONS IN THE BRITISH PARLIAMENT, FOR UP-
WARDS OF THIRTY YEARS, IN SUPPORT OF THE CLAIMS
OF JUSTICE AND HUMANITY, WILL RENDER HIS
NAME DEAR TO SUCCEEDING AGES,

THIS VOLUME OF ESSAYS

IS,

WITH THE MOST CORDIAL ESTEEM,

RESPECTFULLY INSCRIBED,

BY

THE AUTHOR.

GEORGE DEWEY

THIS VOLUME OF LETTERS

ESSAY FIRST

ON THE

OBSTACLES TO AGRICULTURE,

AND THE

MEANS OF REMOVING THEM.

*Il faut gagner les cœurs, et faire trouver aux hommes
leur avantage dans les choses, ou l'un veut se servir de leur
industrie.*

FENELON.

INTRODUCTION.

THE Essays which compose the present volume, were written at the request of the President of the Board of Agriculture, and were intended, with some variations, to form a part of the General Report proposed to be laid before Parliament by that Board; but were withdrawn by the Author, and published in their present form, from the following considerations. When the subject was first mentioned to him, he understood that it was the intention of the Board to have every part of that Report drawn up by men who had actually practised agriculture *as a business*, each individual being desired to write out such parts of it only as he had had occasion to be particularly acquainted with, in the course of his own practice, leaving the other parts to be drawn up by such men as had had more experience in these departments. As this plan appeared to be better calculated to obtain authentic

practical information in agriculture, than any other the Author had ever seen; and as he conceived a work of this kind to be much wanted, he readily agreed to lend every assistance in his power to forward the undertaking; and set himself with alacrity to write out such parts of it as his own experience best enabled him to do. When he had made a considerable progress in this task, he learnt, with concern, that he had totally misunderstood the meaning of the Board of Agriculture, in regard to the proposed Report; and that, instead of proceeding as above stated, and allowing every paper on these subjects to be printed under the eye of the writer, subject to such limitations and corrections only as the Board should suggest, and he approve of,—it was intended that these papers should be first circulated among a number of gentlemen, who were to be severally authorised to alter, cancel, or add whatever they thought fit; and then the work, thus altered, without either the knowledge or the consent of the original writer, was to be published. No sooner was this understood by the Author, than he made haste to inform the President of the Board, that, understanding such was the proposed plan of publication, he begged leave

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to decline having any hand in that work : On being pressed to give his reasons for thus declining, he candidly stated, that as he had never written one line in his life with a view to publication, especially on agricultural subjects, which he could not with truth assert had been seriously intended to communicate some information that he deemed useful to the reader, he could by no means consent that any of his agricultural writings should be altered before publication, unless such alterations should be first seen and approved by himself. He knows well, that much harm has been done by theoretical notions having been published under the form of practical directions in agriculture; and had he submitted to the plan proposed, he might have eventually become a sort of accessory in misleading the unwary, instead of guarding them from error, which he hath ever studied to do, with the most cautious circumspection; and from which plan of conduct no consideration on earth shall ever induce him to depart. He may himself, doubtless, like every other man, fall into error, and will be thankful to any one who shall point out such errors, that they may be corrected; but he ever shall study, as he hitherto has done,

not only to avoid them himself, but to guard others also against error, as much as is in his power.

The essays thus written were allowed to lie by him for some time, without any thoughts of publication. But when the prices of corn had risen to the alarming height they have now attained, his attention was turned once more towards them. And as in these essays many of the circumstances, that operate towards diminishing the amount of the agricultural produce of this country, are developped with much precision, he thought no time could be more proper than the present for such a publication ; and that indeed the circumstances of the times demanded it.

The Author, who now wishes rather to withdraw himself from the busy scenes of life, than to push himself forward in the world, having no pretensions to the character of a fine writer, nor ambition to acquire a reputation of that sort, would make an apology for the language in these essays, if he thought the subject required it ; but in matters of this sort, refinement of language will not be expected. As his object has ever been rather to inform, than to entertain, his attention has been directed

rather to the matter than the form. His chief study has been to acquire so much perspicuity, as that his meaning could not be in any case misunderstood; and to write in such a manner, as tended to induce the reader to attend to facts, and draw the necessary conclusions from them *himself*, as they incidentally may in future occur, than implicitly to rely on such casual statements as may fall in his way: and some peculiarities of manner will be found referable to this head. Indeed, as the chief inducement to his writing at all, was a desire to render some truths, which his own experience hath taught him the importance of, more generally known and adverted to, than they seem hitherto to have been, he sometimes presses these with a degree of earnestness that may lead him, like the Abbé de Saint Pierre, to recur to these subjects oftener than the fastidiousness of modern criticism might judge allowable: like the good Abbe, too, while he is willing to admit, that, if literary fame had been his chief object, the criticism may be just; yet with him, also, the Author shall be entirely satisfied, if at the price of reputed inelegance, he shall be able to draw these objects into notice: for as he now looks

with a comparative degree of indifference on that kind of literary fame which so much attracts the attention of younger men, and is neither anxious for wealth, nor future aggrandisement, he proceeds in these disquisitions with a steady earnestness, which to those who are accustomed to the writings of men who are actuated by other views, may at times assume somewhat of a harsh and ungracious aspect. He is not conscious, however, of being actuated by the slightest unkind propensity towards any human being; and he hopes that, when duly considered, a serious desire to promote the welfare of those who have not adverted so much as he himself has done to the subjects treated, will be found to be the prevailing characteristic of the work. He has stated what he deems important truths with the greater freedom and precision, because he believes that, should he neglect to do it, few others would feel themselves inclined to do so. From this last consideration, he is perhaps better pleased that the publication is in its present form, than if it had been given to the public as was originally intended: for several facts are here stated with less reserve than he fears the Board of Agriculture would have been willing to al-

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low, if the work had been published under their patronage.

He begs that the reader may understand that the facts alluded to in the following letters, had no share whatever in his determination to withdraw these essays from the Board : for it is a truth, that he had intimated such intention to the Board, with the reasons for it, before he had any knowledge of the facts which gave rise to the second letter. These letters are here reprinted, merely with a view to vindicate the character of the Author from the slur that was apparently thrown upon it by the conduct of the gentleman to whom they are addressed, and to prevent that vindication from being overlooked by the readers of these essays. Had it not been for the unfavourable impression that the conduct reprehended in the second of these letters, would have made upon the public mind, in the apprehension of the author and his friends, respecting his character, this last letter would never have been either written or published : but as the evident imputation of the want of *moral rectitude* was public, nothing but a public vindication could be in any degree competent : for the author will never suffer any such impu-

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tation to remain unrefuted, in as far as a candid statement of facts can do so, by whomsoever it may be made.

TO SIR JOHN SINCLAIR, BART.
PRESIDENT OF THE BOARD OF AGRICULTURE.

LETTER FIRST.

SIR,

{ *Cotfield, near Edinburgh,*
30th June 1795.

I USE the freedom to trouble you at present on the subject of draining adopted by Mr ELKINGTON, not with a view to detract from the merits of that gentleman, nor to find fault with the remuneration you have obtained for him, but merely to set you right in regard to a matter of fact concerning me, which might easily escape your notice.

I presume, Sir, you thought it evident, from the statement made by Mr Elkington, that the mode of draining ground which has been so successfully practised of late by that gentleman, was an invention peculiarly his own. That this is not the case, admits of evidence, which I hope you will allow to be satisfactory.

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It is now twenty years since I published a book, called *Essays relating to Agriculture and Rural Affairs*. If you will take the trouble of turning to the second essay in that work, which is, *on draining Bogs and swampy ground*, you will there find the method of draining, by means of *tapping*, which has been adopted by Mr Elkington, fully explained, and the principles upon which it may be practised clearly developed, by the aid of illustrative figures, discriminating plainly the cases in which that mode of practice would be improper.

I do not understand that Mr Elkington practised this method of draining before the publication of that work, (*anno 1775*,) neither do I mean to assert that he adopted the practice from the directions there given. I readily admit that the principle is so simple, and so obvious to every considerate mind, that it would certainly be nothing extraordinary, if he, by his own reflections alone, should have discovered it, as well as I did. There is only one particular in his mode that I myself had not practised before that Essay was published; viz. the making the tapping by means of a *boring instrument*; but even this I have particularly described, as you will find in the following

words, at page 181. (*Third Edition Vol. 1.*) of the foreſaid Eſſays. After deſcribing the mode of tapping I had adopted, by ſinking ſmall pits, and explaining the caſes in which it may be ſucceſsfully practiſed, it is added, “ I have often imagined that the expence of “ digging theſe pits might be ſaved, *by boring “ a hole through this ſolid ſtratum of clay with “ a wimble (an auger) made on purpoſe ;* but “ as I have never experienced this, I cannot “ ſay whether it would anſwer the deſired end “ exactly.”—Neither can I *now* ſay, whether Mr Elkington grounded his practice on this hint or not ; but I may ſafely ſay, if he did not, he might have done it : And as I could not have borrowed it from him, if there be any merit in the *diſcovery*, I have aſſuredly a juſt title to claim it.

I wiſh not to throw out any inſinuation to the prejudice of Mr Elkington, who, by a proper degree of management on his part, has great merit in having turned the attention of the nation towards a mode of draining, which, if the principles upon which it is grounded are fully underſtood, and properly applied, will be found to be equally cheap and efficacious ; as I myſelf, from an experience of it for more

than thirty years, can safely assert. But it is a mistake, to think it can be universally applied. There are many cases in which it can be of no use, and therefore it were vain to attempt it; as I have fully demonstrated in the treatise referred to.

Whether Mr Elkington did actually discover this mode of draining of himself, or adopted it from the very plain directions given in that treatise, is of little consequence to the public. In either case, he has alike the merit of having introduced it into practice in the southern parts of this Island: for the simple fact that he has been *supposed* to be the first inventor of it, is the clearest proof that this part of my treatise, *by how many soever it may have been read*, has been allowed to remain, in a great measure, a dead letter, even till the present hour.

As my intention in publishing that Essay doubtless was to benefit the public, I owe, perhaps, thanks to Mr Elkington, for having thus forwarded that design. It is not impossible that the time may not be far distant, when I shall be laid under a similar obligation to some other person, for bringing into practice, *as a new invention*, the mode of embanking rivers,

which is described in the Essays referred to, with a similar degree of clearness; and which, when reduced into practice, will be an improvement equally cheap and efficacious with the above. An obligation of this sort was conferred upon me, some years ago, without my knowledge of it at the time, by a Mr BRODIE, I think the name is, when he brought into notice, what he called the *Patent Bath Stove*; the principle upon which that stove is constructed, having been explained, and clearly illustrated by means of a plate in a treatise of mine "On Smoky Chimneys," that was first published in the year 1769; but this particular was little adverted to for several years, till Mr Brodie, by a *little proper management*, brought it into notice §. My ideas, freely communicated to the public, have been a source of emolument or of honour to *others* also. My own reward has been the satisfaction of having done what I know to be right, and the *honour* of being indirectly flattered by compliments that were publicly appropriated to others.

Wishing you success in your laudable undertakings, which, if properly supported, can-

§ It is generally believed that Mr Brodie has realized an hundred thousand pounds by this contrivance.

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not fail to be attended with effects highly beneficial to the nation, I have the honour to be, with due respect,

Sir,

Your most humble Servant,

JAMES ANDERSON.

LETTER SECOND.

SIR,

*Cosfield, near Edinburgh,
10th January, 1796.*

SINCE I had the honour of addressing you in public on the subject of draining land, I have learnt that a controversy has been carried on in the Newspapers to some length, upon the same subject, by various persons. Who these persons are, I know not; and with the particular object each party has in view, I am in a great measure unacquainted. I never saw one of these publications except two, which accidentally fell into my hands in September last, when I passed through London. The present letter, therefore, must be considered as having no connection with, or reference to these pub-

lications; and if any thing shall here occur that shall tend either to corroborate or oppose any of these writings, it must be considered as merely accidental.

Since my own letter above alluded to was written, I have seen two publications by the President of the Board of Agriculture, in which the draining of land has been mentioned. The first is an Address to the Board of Agriculture, dated 14th July 1795, in which it is taken notice of in these words: "The Board has succeeded in its first application [*i. e.* to Parliament for a reward on account of *discoveries* advantageous to Agriculture,] in behalf of a very deserving individual, Mr Joseph Elkington, *who has carried the art of draining to a perfection hitherto unknown.*" The second is an Address to the Board of Agriculture, on the cultivation and improvement of the waste lands of *Great Britain*, by the President, printed 23d December 1795, in these words: "A considerable proportion of the wastes of Great Britain consists of lands of a wet and boggy nature, which it has been yet supposed was the most difficult to improve and cultivate. Fortunately, however, *discoveries* have been made in the art

“ of draining such bogs by Mr Joseph Elkington, a farmer of the county of Warwick, as renders the improvement of swampy land a matter of much less difficulty or expence than formerly.” My friends think that in both these passages there is manifestly a *marked* determination to set aside my claim to any share in the discovery of that mode of draining, and a studied care to avoid my name in any way, lest it might imply some sort of derogation from the merit of Mr Elkington; and they farther think, that after the public claim I have already made to that discovery, it would argue little less than a consciousness of the injustice of my claim, should I suffer such a public affront to pass unnoticed. As some of Sir *John Sinclair's* best friends, with whom I have spoken upon the subject, concur in the same opinion, I find myself called upon to urge a farther explanation on that head; which is one of the principal objects of the present address.

The question at issue may be reduced to a very narrow point, which is this. The practice of Mr Elkington is, in its principle, either the same with that which was practised by me, more than thirty years ago, and published as

above said ; or it is not. If it be the same, then doubtless Mr Elkington can have no just title to be held out to public view *exclusively*, as the *discoverer* of this practice ; for I presume, he will not alledge that, at the time of the discovery, I had ever heard of him or of his practice. Indeed, I never did hear of either, till his name was first mentioned in some of the publications of the Board of Agriculture. On the contrary, as it is certain that my discovery was published more than twenty years ago, and that Mr Elkington has never till this hour published his ; but has been going on from imperfect beginnings, gradually improving as he went on, it is not so clear that he may not have borrowed some hints to direct his practice, either directly from my treatise, which has been pretty generally read in Lancashire, or from the conversation of some persons who had read it. From these considerations, if the principle be the same, it will be difficult for the President of the Board of Agriculture, to clear himself from the imputation of a marked partiality in the passages above quoted ; especially after my having pointed out to him, in my former letter, the passages in my Essays that directed the same

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method of practice so long ago as has been already specified. If, on the other hand, the practice followed by Mr Elkington differs in principle from that which I had so long ago explained; in that case, the President of the Board of Agriculture may be with reason accused of injustice to the public, by having delayed so long to explain the principle of that useful discovery; for, as the public have already paid for the discovery *, they have a right to demand that it should be made more generally known for the benefit of the whole community; in the same manner as Mr Forsyth's receipt for recovering decayed trees was published, on receiving his premium. I therefore, in the name of the public, demand of you, Sir, who have taken the lead in this transaction, to publish this secret, that all the world may be enabled to know it, and to avail themselves of it, if they incline, without being obliged to have recourse to Mr Elkington himself, who, in this instance, like the venders of

* It has been publicly asserted by the Board of Agriculture, that Mr Elkington refused to discover his method till he obtained for the secret one thousand pounds, which were granted to him for that purpose, by Parliament, last year.

quack medicines, carefully conceals his secret, that he may be enabled to profit by the credulity of the public. And shall the President of the Board of Agriculture demean himself so far, as to give countenance to such transactions !!!—I will not suppose that such can be the case. Yet appearances are against you.—Inadvertence may have led you to adopt a language that is fairly susceptible of that interpretation; and you cannot take too early an opportunity of doing it away.

It will be the easiest thing imaginable for Sir John Sinclair to clear himself from this charge, and settle the matter,—simply by publishing the principles on which Mr Elkington's method of draining are founded. This can be attended with little trouble:—For as Sir John must fully understand the principle himself, (otherwise it would be an insult to suppose he could have adopted a language so strong and decisive as he has done)—he can find little difficulty in explaining it, as a supplement to one of those publications that are every day issuing from the press, at the expence of the Board of Agriculture.

Such a publication is likewise necessary on Mr Elkington's account, if he means to free

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himself from the imputation of quackery ; which idea, the manner in which he has been introduced to public notice by the Board of Agriculture, has a strong tendency to countenance. This ought to be done away, if he wishes to gain that respectability of character to which superior talents should naturally entitle him. With such men, *candour* is ever a leading characteristic feature ; for, however far concealment and deception may lead to emolument in certain cases, it never can be accounted honourable. Now, if Mr Elkington is sensible that he understands the principles upon which his practice is grounded, so completely as to be able to explain it in such a satisfactory manner, as to set at defiance the critiques of philosophical investigators, he can have no objections to publish it. He has received a price for it ; and not only honour calls for it, but *justice* requires it at his hand. If neither the President, nor any other member of the Board of Agriculture, nor Mr Elkington himself, shall, after being thus called upon, publish the secret that he has sold, the public will be disposed to believe that Mr Elkington cannot do it, and that he has availed himself of the influence of some great man, to impose

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upon the President and the Board of Agriculture, who have thus, in their turn, been induced to lend their aid to enable him to dispose of his nostrum to the best advantage. From these considerations, it alike behoves the President, the Board of Agriculture, and Mr Elkington himself, to lose no time in publishing his secret. Among other good effects that will result from this measure, it will totally preclude all farther altercation, respecting the merit of this discovery, between him and myself, or others.

Till such publication appears, it may not be improper in me to observe, that another body of men, who have had good opportunities of information, have thought proper to adopt a conduct respecting this particular, very different from that of the President of the Board of Agriculture. The gentlemen who compose the Society of Agriculture at Altringham, near Manchester, in the county of Lancaster, having determined to encourage the draining of land by means of tapping, judged that a respect for their character required them, in this case, to act with the strictest impartiality: And thinking it would be of use to those who were to attempt it to know the principle on which

success depended, as well as the mechanical practice of the art, the Society offered a premium to those who drained the greatest quantity of land according to the practice followed by Mr Elkington, on the principles explained by Dr Anderson, in a book called *Essays relating to Agriculture and Rural Affairs*.

The following is Mr Elkington's own account of the way in which he was first led into the train of discovering his mode of draining by means of tapping, as it was told to me by a gentleman of great veracity, who had it from Mr Elkington himself; and it appears to be so natural, as fully convinces me that it is strictly the truth. Mr Elkington's father having died about the year 1763, left him in possession of a small farm of wet four land. He found that no good could be made of it without previous draining. He accordingly set to work to drain it in the usual way; but after having laid out as much money as his narrow funds could afford, he had the mortification to find that no benefit had resulted from his labour; which tended very much to discourage him. While he was in a state of despondency on this account, he, by accident, dug a little deeper than usual in one of his drains, and found, to

his great surprise, that a copious spring of water burst forth from the hole, which continued to flow with a plentiful stream for a very long period of time. He dug deeper in several other places with the same effect, though the streams were less copious than the first. In consequence of these openings, he had the satisfaction to perceive, that his fields gradually became drier and drier, till they at last were perfectly freed by it from all the superfluous moisture. And not only were his own fields thus drained, but the contiguous land, for a considerable distance all round, was made drier also by the operation. This circumstance led him to suspect, that in other cases, where the surface-appearance of wet land was somewhat similar to his own, they might be drained by making openings resembling to those above named. Success attended his operations in many cases; and he gradually went on in his practice, correcting his first errors by experience, and improving upon it till the present time.

From this account, it would seem that the discovery was, as to him, merely accidental; nor does it appear, from the above, that he had any clear idea of the manner in which the

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draining is thus effected, or the principles on which it depends, so as to be able to distinguish *a priori*, those cases in which that mode of draining could be of no use, from those where it must of necessity prove efficacious.

As to myself, the discovery of that mode of draining was made in the following manner: I had a field of wet land that lay very flat, but so surrounded by ditches, that no surface water could come to it from higher ground any where, and possessing at the same time such a level as to prevent any water from necessarily stagnating upon it. The field was so wet, that in many places it was a meer hobbling bog, over which a man could scarcely pass during the driest weather in summer. This was a very unprofitable as well as disgusting object; and, in the beginning of the year 1764, I set about seriously to have it drained. On considering the circumstances of the case with attention, I soon perceived, that as no *surface-water* could come upon it from the higher ground; and as the rain that fell upon the field itself was suffered freely to run off, the water that drowned it must rise up from *below*. But as the weight of the atmosphere acted on this field as well as on those around, the water

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could not be made to ascend, as in a pump, by means of suction: it must, then, be forced to take that direction in consequence of some powerful pressure from below ground, acting so strongly as to overcome its natural gravity. This pressure, it was evident, could only be in consequence of the water flowing from higher ground, *under the surface*, through a stratum of pervious matter, being pent in near the bottom by a stratum of clay placed above it, and thus forced to rise to a higher level than the low ground, in this kind of subterraneous canal, so as, by the natural power of gravity, to be squeezed forcibly through small fissures in the superior stratum of clay. If so, it would necessarily follow, that should a hole be dug through the superincumbent stratum of clay, so as to reach the bed of the reservoir, the water would be allowed to issue freely through that opening, and to run off the ground by its natural level; and thus would the accumulated water, which occasioned the pressure, be gradually discharged, after which it could no longer be forced up through the small fissures in the clay; and, of course, the wetness, that had arisen solely from that cause, must be gradually removed. On this reasoning, which

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seemed perfectly conclusive, and which was confirmed by observing that the subsoil of that field was every where a very stiff clay, mixed with small stones, the dry weather was no sooner set in, than I put a man to dig a pit as near to the edge of the swaggle as he could approach, ordering him to penetrate directly downwards, making the pit no larger than was sufficient to allow him to work, and to proceed without interruption, until he should perceive that, on making his strokes, it should sound as if it were somewhat hollow below. On observing this, he was desired immediately to desist, until he called me and received farther orders. The labourer accordingly fell to work; but he found the ground so hard, that, in the course of two days, he had only penetrated to the depth of about five feet. During that time I frequently visited the work, to examine appearances. Nothing remarkable occurred, save that little peering springs often were discovered, through which the water issued; but the quantity of water that came from them was not such as to interrupt the work. On the morning of the third day, about breakfast time, the labourer called on me, and said, that as his stroke gave a *douf sound*, (that was his

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phrase,) he had called me according to my desire. I went immediately with him to the place, and having made him go down into the pit, I desired him to show me in what manner he could come out of it. He then pointed out to me a kind of steps he had made into the clay on one side; and having lent him my hand to assist him, I found he could get out very quickly. I then ordered him to take a kind of sharp pointed iron crow, with a cross handle and foot to it, which he had found a very useful tool in loosening the clay, and give a stroke of that with all his force upon the bottom, which he did.—On this, to his great surprise, the tool penetrated a thin crust, and then fell down, from one to two feet, as in a vacuity. Through the opening thus made, a strong jet of water rushed instantly with great impetuosity; but I, being aware of it, and at hand to assist the man in mounting, he got very quickly to the surface, and out of all danger, though not a little terrified at what had happened. The stream was at first so large, as might, I suppose, have filled a pipe of from 6 to 12 inches diameter; and rose, as a *jet d'eau*, to the height of six feet at least, above the surface of the ground. The labourer, who

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had no idea of such a phenomenon, looked upon it with an overpowering astonishment, which would have furnished a fine subject for the painter. The stream continued to flow, and to rise above the surface of the ground for about a week ; but gradually abated in height, till it arose not above the surface of the ground, and continued still to flow ; but the quantity of water gradually diminished, till it at last settled into a perennial spring, which continues to run till the present day.

The consequence of this operation was, that during the course of the ensuing summer, the water gradually drained off from the boggy ground ; the swaggle slowly acquired a firm surface, so as to admit of being plowed at any season ; and about twenty acres of ground were thereby drained, which, before that time, had been in a great measure useless for every agricultural purpose.

Ten years afterwards, being about to publish an Essay, containing directions for draining all the different kinds of wet grounds that occasionally prove detrimental to the farmer, I naturally specified this variety of wet ground among the others, and gave a plate explanatory of the cause of that phenomenon, as I had

done of the others, in order that every person who chose it, might be enabled to distinguish the case, and apply the remedy himself, if he so inclined. The Essay has been now in the hands of the public above twenty years, and will speak for itself; so that more need not be said here on that head, further than that all these facts could be *proved*, were it thought necessary to do so.

I may add, however, at present, when I find that a disposition is manifested, on some occasions, to withhold honour from those to whom honour is due, that though I did not think it proper, in a work that professedly treated of agricultural concerns only, to specify all the useful corollaries that might be drawn from the physical appearance above explained, I may now, without any impropriety, barely mention, that from the application of this principle, many phenomena may be explained in a very satisfactory manner, which have been hitherto reckoned cases of great difficulty. Some of these, (particularly the case of a well that was sunk at Tilbury Fort, on the Thames, as narrated in the Phil. Tran. Vol. in which an abundant spring of *fresh* water was found, at a great depth below the surface of the sea,

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after two springs of *salt* water had been passed through above it,) I pointed out, in a letter I did myself the honour to write, several months ago, to Leigh Philips, Esq. of Manchester, who had been kind enough to say that the Essay referred to was what he conceived to be a *complete system of draining*. This expression induced me to show him it could not be deemed *complete*; as several cases were omitted, which I then specified to him: among others, it was made evident that deep lakes, surrounded by mountains of great height on all sides, may, on some occasions, be entirely drained, by *boring*, or sinking shafts downwards, sometimes to a moderate depth: That also wet-land may, on some occasions, be more easily drained, by opening an outlet for the water *beneath* the reservoir which occasions the wet, than by bringing it up to the surface. And that, among mountains, it may frequently be much cheaper to carry off superfluous water from mines, by penetrating downwards, than by driving a horizontal level to the surface of the ground, which is in many cases attended with a ruinous expence. These corollaries are indeed so obvious, when the principle is once explained, that it must appear astonishing to

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any considerate mind they have not been made, and very generally applied in practical cases, long before the present period; and I here specify them, merely to direct the attention of men to an object from which much practical good may be derived, in a variety of cases, which it would be tiresome in me here to enumerate.

I have farther to add, on this head, that there is one variety of wet ground which had totally escaped my notice in that Essay, and which has not, that I know of, been treated by any writer on agriculture; though it is perhaps more universally hurtful to the farmer, than any other kind of wet land whatever. This I shall have occasion particularly to explain, in the second Essay of the present work, on the improvement of waste lands.

From the facts that were stated to the committee of the Board of Agriculture, in favour of Mr Elkington's mode of draining, as published in their *report*, dated June 5th 1795, there seems to be reason to suspect, that Mr Elkington himself, even at that period, was not fully aware of all the circumstances that were essential to the practice of draining ground, in the most economical manner, by means of

tapping;—as the labour and expences incurred in many of the cases there specified, seem to be much greater than that mode of draining, judiciously applied, could possibly have required. But as these cases are stated by gentlemen who did not themselves fully understand his method, they may possibly have been done with some degree of inaccuracy. When Mr Elkington himself shall publish his own method, that doubt will be removed; and every individual will then be able to judge for himself as to this particular. If his practice be as good as it is said to be, it cannot be too soon or too generally made known. If it shall be defective in any respect, these defects cannot be too soon pointed out and rectified; which would probably not be long delayed after the publication required.

I shall be sorry, if, in consequence of the precipitate conduct of Mr Elkington's friends, I have been obliged, for the purpose of obtaining impartial justice, to say any thing here that may tend to prove in the smallest degree detrimental to that gentleman. I look upon him as a very worthy member of society; and I believe him to be an honest man. I have not a doubt but his practice has already been of

much national utility, and will be of still more, the wider it is diffused; even although it should not be carried on in the most perfect manner of which it will be found to be ultimately susceptible: and I can assure that gentleman, with much sincerity, that there is not a man in the land, not the President of the Board of Agriculture himself, nor his still more powerful patron, who will rejoice more in his prosperity than myself; or who would more gladly lend his aid to the extending his practice as wide, and the rendering it as perfect, as possible. It is perhaps unfortunate, when a plain man finds himself forced to come forward in the genteel circle,—especially where such person may, by the ill judging partiality of ignorant friends, be induced, from the hope of benefiting his family, to acquiesce in statements that he himself would never perhaps have made,—even though he be backed by those who have the most powerful influence. For it is not in this nation, that influence can altogether suppress the voice of reason, or ward off entirely the severity of reprimand, when the insolence of supposed power provokes a scrutinising enquiry.

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I have now, Sir, done with the business of Mr Elkington, but am sorry that in justice to myself, I am not yet at liberty to put an end to this, I fear, ungracious epistle.

It appears to me very strange, that I should have occasion, at one time, to complain of having been ill used in *two* respects, by Sir John Sinclair, as I am not conscious of ever having merited any thing of that sort at his hand, *but much the reverse*. It unluckily happens to be so however at present. The trespass, too, is of such a kind as to require that notice should be taken of it in the public manner I now do, in order that I may remove, in part at least, the injury that, by his improper conduct, must have been done to my character. I shall briefly state the facts, for the justness of which statement I appeal to yourself.

Immediately on receiving a letter from the President of the Board of Agriculture, in February last, requesting that I would favour the Board with any information I could give respecting the culture and uses of Potatoes; I sat down, and in great haste put upon paper such observations as occurred to me at the moment. These observations, without revision or corrections, were instantly forwarded to the

Board, under cover, addressed to the President, and were accompanied by a letter, stating that I had lost no time in complying with the wishes of the Board respecting the subject of Potatoes, and that the papers which accompanied that letter, contained what appeared necessary for me to say on that head. But I added, that these remarks were intended solely for the use of the Members of the Board itself, and "were not intended to be *published*." This I forbade in the most positive manner; and even requested that the Board would be so kind as not to mention my name in any publication they might think proper to make on that subject; desiring that the papers might be returned to me, after the Members of the Board had satisfied themselves with regard to them. So anxious was I that this requisition should not be forgotten, that I mentioned it no less than three times, in as many different letters I had afterwards occasion to write to Sir John Sinclair; and as the franks had been reduced in weight before the last letter was written, I desired him, with a view to avoid the trouble of addressing so many covers as it would then require, to send the M. S. to my son in London, who would take care to get it forwarded

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to me. After all this, the reader will judge of my surprise, when I read these words in a letter from Sir John: "The Board has at length finished its publication on the subject of Potatoes; *and as you have been a contributor to it*, you are entitled to a copy of it." In what manner I had become a contributor to that work, I could not well conceive; for I did not then imagine that ever he could think of publishing what I had so positively forbidden: but as some observations of mine on Potatoes, had been printed in other publications, I thought something might have been extracted from these works, to which this passage might allude. I took the earliest opportunity that offered, to consult that work for my own satisfaction. My astonishment at seeing the observations printed entire, with all their faults and others superadded, and thus forced upon the public notice, "unanointed, unanelled;" and the indignation I felt at this unexpected insult, may be easier conceived than expressed. I call it an insult, because I conceive that no one acting in the character of a gentleman, can have a right to publish the writings of another, even without his consent, far less, if contrary to his express injunc-

tions, clearly announced, and repeatedly enforced. You, Sir John, have it in your power, by publishing my letter, to correct me if I misrepresent the fact. If I have stated it justly, it is incumbent upon you, to make such an apology as one gentleman ought to give, and another to receive.

What adds *injury* to the *insult*, on the present occasion, is, that from the whole tenor of the writing, it was obviously intended for private information only, and not at all for the public use; and if you had taken the trouble to read, with an ordinary degree of attention, the first sentence only, you could not have failed to perceive it. You need scarcely be told it may be extremely proper to express in a particular way, what was obviously calculated for the private perusal of a few gentlemen only, who were about to judge of matters that were not within the sphere of their observation, though it would be exceedingly preposterous to make use of the same expressions, when intended to be laid before the best informed professional men in the kingdom. The observations which, in the one case, would only be calculated to induce that cautious circumspection which men of professional knowledge,

in any line, are in some measure required to use, when called upon to assist those of less experience, whose situation in life incidentally may bring them to decide in matters respecting that profession; but, in the other case, as being addressed to professional men, many of whom may be supposed to be equally well informed as the writer himself, could be considered as little better than an insult, and would indicate an overweening presumption in the writer, that could only excite disgust and contempt. Such, in fact, is precisely the case in the present instance; and the words of the introductory paragraph to that Essay, if they were supposed to be intended for publication, can only be calculated to make an impression on the mind of every reader that is very little in favour of the writer; and what I conceive to be extremely different from what my own character, if not obscured under such an humiliating disguise, ought naturally to produce. I feel, at least, that if any other person had written such a paragraph, intending it to be published, as this has been, I should have despised him as an impudent coxcomb, whom it would be a merit to humble. Sir John Sinclair is as capable as any man of judging of

the irresistible effects of such impressions on the public mind: nor would there have been any thing extraordinary in it, if he had, on receiving such a paragraph for publication, from a man with whom he was in habits of intimacy, requested him to reconsider it, to see how far he thought it proper for the public eye, on the supposition that it had escaped his notice through inadvertency. But to publish it in that imperfect state, though contrary to the express orders of the writer, repeatedly enforced, without giving him even a hint of such an intention, was using a freedom which no man, whatever his situation in life may be, has a right to take with another. The law has provided a punishment for him who injures his neighbour's good name. The injury may be as great when it is done in this way as any other, though it has, perhaps, hitherto escaped the notice of Legislators. With those who shall read this letter, perhaps *a part* of the injury may be done away; but Sir John ought to consider that thousands may have seen the publication alluded to, who may never have an opportunity of reading this, and that the writer must continue to be despised by them till the end of time.

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Besides the circumstance above alluded to, there are other blameable particulars originating from the publication of that performance by the Board of Agriculture, that must affect the character of the writer ; for so little attention has been paid to the printing, that, from the incorrectness of the press, he must, in some cases, appear to write in a manner altogether unintelligibly, and, in others, he is made to speak perfect nonsense ||. I will not say that these things were intended : But is it fit that one person should suffer a material injury, through the carelessness of another ; especially when that is produced, not in the ordinary course of business, but is occasioned entirely by the culpable forwardness of that person ?

I am happy at being now come nearly to the close of a letter, the writing of which has

|| **EXAMPLES.** I had said, ‘ But now that *fresh* kinds are obtained from *seeds*,’ which is printed, ‘ But now *the* fresh kinds are obtained from *reds*.’ I had said, ‘ Nor are those kinds that send their bulbs deep in the ground, so *desirable* as those that rise upwards,’ which is printed, ‘ So *durable* as those that rise upwards.’ I had said, that in a rich mellow soil the roots would be ‘ able to strike with ease, and *find* abundant nourishment ;’ it is printed, ‘ And *send* abundant nourishment.’

been to me a very unpleasing task ; for I mean not to bring forward any other complaints against you, at this time ; and hope I never shall be forced to do so, at any future period. I do not take pleasure in finding fault ; and in few cases could it prove more irksome to me than the present. Anxious as I have been, through the whole course of my life, to see the prosperity of this country augmented, by promoting the peaceful exertions of rural industry, and thus preserving the morals of the people untainted, the only sure basis of national welfare, I cannot but feel a sensible regret at any degradation of the character of the man who has taken the lead, for the present, in that laudable undertaking. Undoubtedly nothing tends so much to exalt a man's character, and to give him superior weight on all occasions among his equals, as that unbiassed integrity, which, rising above those partialities and prejudices that are inseparable from little minds, presses steadily forward in its course, without wavering, however assailed by the tempting lures that may be held out to it, on either hand, by the artful and designing. It was this that raised Aristides, the Athenian, to that exalted pre-eminence that

suppressed even competition itself, and gave him singly the power of adjusting the claims of rival states. Such a character commands respect, even where talents are rather defective; and will make errors themselves be overlooked by most men: but where this divine attribute is wanting, the most brilliant talents display their lustre in vain; and even the most useful pursuits, by such men, are frustrated. I have been hurt, Sir John, at the obvious partiality of your conduct towards myself, and the apparent design, unfairly, to lessen my character with the public. Should a similar weakness, to use the mildest expression, be perceived in regard to others, the influence of the Board of Agriculture must soon be lost with the public. It will only be then viewed as one of those tiny institutions that are calculated to soothe the vanity, or to augment the political influence of certain individuals for the time. I most anxiously wish that this may never be the case; and shall only add, that if any thing I have here said, shall, by inducing a little more circumspection, where the reputation or the interest of others may be affected by any casual inattention on his part, tend to render the character of Sir

I INTRODUCTION.

John Sinclair still more respectable than it has hitherto been, it will add to the pleasure and happiness of

SIR,

Your very sincere well-wisher,

JAMES ANDERSON.

It was intended to have published two other essays at this time ; but the volume is of too large a size without them, even although many parts of the essays themselves that are here published have been suppressed, and the observations on the corn laws at the end exceedingly curtailed.

Two omissions in the first essay require to be here mentioned, because the treatise appears to be incomplete without them. The first respects mills in the Vth section, no notice being there taken of the practice called *thirlage* in Scotland. The reason was, that from the agricultural surveys of the different counties, this practice does not seem to be much felt as a grievance in England, and therefore it did not require to be insisted on in a treatise that respects England only. The

second omission is, that respecting the law for parish settlements in England, which should have been noticed under the XIVth section, which treats of fiscal regulations that are hurtful to agriculture. This, as a necessary consequence of the poor laws, is slightly noticed under that head, in section XIth. The political disorders that originate from the law of parish settlements, however, being great and numerous, and having never yet been fully developped in any treatise known to the author, it appeared to be an object of too great importance to admit of being treated in a cursory manner, and of too great magnitude to be, otherwise, inserted in that place: it was therefore reserved for a separate dissertation to be inserted as an appendix; but the bulk of the volume prevented its insertion. I shall only here remark, that it seems not a little surprising, that a nation, which is so proud of its freedom, and so justly jealous of any infractions of it, as Britain is, should tolerate within itself, without seeming to be sensible of it, a species of slavery, which, if it was seen to exist any where else, would be reprobated as the most miserable thralldom that could be conceived. Every thinking man, who reflects up-

on this subject, will at once perceive the extreme pernicious tendency of this institution in a variety of ways, some of which are not indeed so obvious to casual observers as could be wished: On which account I beg leave warmly to recommend the law of parish settlements as a subject well deserving the pen of some able investigator. Under such hands it would furnish an excellent subject for a separate dissertation.

It was also once intended to have noticed, among the obstructions to agriculture, in the first essay, the speculations of literary men, and the attempts of men of great wealth and property, to practise agriculture; as also books on agriculture, of a certain description: But to free these propositions from the appearance of paradox, would have required so many explanations and exceptions, that it was judged more expedient to omit them entirely. They are mentioned here only, that practical farmers, in whose eyes these must often appear to be great and evident obstructions, may see they were not entirely overlooked by the author.

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ESSAYS, &c.

ON THE OBSTACLES TO THE ADVANCEMENT
OF AGRICULTURE IN ENGLAND, AND THE
MEANS OF REMOVING THEM.

INTRODUCTION.

THE discouraging *Report* of the Lords of the Privy Council, which was published a few years ago, concerning the deficient state of the agricultural produce of this kingdom, was so little calculated to flatter the national pride of the people, as to give a very general disgust at the time ; and many persons felt in their own minds a strong propensity to refute these *ill grounded* assertions, as they thought they could easily prove them to be. This made them examine the subject with an attention it had never before obtained. The consequence has been, like what happened in many cases with the champions of the

Roman Catholic religion against the Reformers, that those who engaged in the contest were finally made converts to that very doctrine which they intended to refute. Among other benefits that have accrued from these discussions, we may perhaps rank the institution of the Board of Agriculture as one, which, if its enquiries shall be prosecuted for a sufficient length of time, with due caution and energy, will be productive of national benefits, greater than perhaps have been derived from any other political institution in modern times. For although the money which has been expended on this department, when compared with that bestowed on any other national establishment, may be considered as nothing, yet, in consequence of its exertions, continued for the course of little more than one year, a body of authentic facts, respecting the agricultural and internal economy of this country, have already been laid before the public, greater than was ever obtained in any other nation since the be-

ginning of time ; on which facts the political enquirer can ground his reasonings, on many of the most important topics that can ever engage his attention, with a degree of certainty he could *never* have otherwise obtained. In consequence of this, many ideal phantoms of proposed national aggrandisement will be banished, and, in their stead, plans of substantial improvement will be brought forward, which could not otherwise have been adopted ; because the obstructions, which repress alike the suggestions of genius, and the hand of industry, would have remained unknown, as they hitherto have been in every European nation, and of course entirely unattended to by those classes of men who alone have power to remove them.

I could not produce a more striking illustration of the truth of these assertions, than the Essay which I am now about to submit to public consideration ; for it will consist of little more than a compressed view of facts that have been

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brought to light by the agricultural surveys of the several counties already printed, some of which facts were unknown, or never adverted to, by every person who shall read this: For I presume no one person in any situation in Britain, could have otherwise had an opportunity of observing the whole; and innumerable persons no doubt exist, who are deeply interested in the discussion, who never before had adverted to one of them: and who of course could never be aware of the very important consequences that flow from them.

By a careful attention to these surveys, the principal obstructions to agriculture, (not to dwell on those that depend upon natural causes, or that may be overcome by individual exertions, but those which owe their origin to political institutions, or which can only be removed by the conjunct exertions of numerous bodies of men,) may, as far as occurs to me at present, be resolved into one or other of the

AGRICULTURE.

following heads, which will fall to be severally discussed,

<i>Commonable fields,</i>	<i>Indefinite claims upon land,</i>
<i>Commons.</i>	<i>particularly tithes, and</i>
<i>Minute divisions of property,</i>	<i>poors rates.</i>
<i>Intermixture of property.</i>	<i>Difficulty of communication</i>
<i>Mills.</i>	<i>between places.</i>
<i>Inadequate size of farms.</i>	<i>Want of proper markets in</i>
<i>Injudicious restrictions, and</i>	<i>particular districts.</i>
<i>want of leases.</i>	<i>Injudicious fiscal regulations.</i>
<i>Want of adequate capital a-</i>	<i>Want of ready means for</i>
<i>mong farmers.</i>	<i>conveying agricultural</i>
<i>Inclosures injudiciously made,</i>	<i>knowledge.</i>
<i>Lands in mortmain, and en-</i>	
<i>tails.</i>	

On each of these heads, I shall make some remarks.

§ I.

*Commonable lands considered as an Obstruction
to Agriculture.*

THOUGH the very phrase *commonable lands* is not known in Scotland, either because the practice which gave rise to the name is not there perhaps in any case strictly adopted, or, if it was of old adopted, it had been distinguished by another name. Yet this practice so universally prevails, either in a greater or smaller degree, throughout every county in England, that it comes forward in each of these surveys in a very conspicuous point of view. From the supposed notoriety of the practice, as I suppose, I do not find that one person, among all those surveyors, has so much as attempted to give a definition of the phrase. It is not difficult, however, from the notices concerning it that are scattered through these reports, to form, as I hope,

a tolerably just idea of the meaning of the phrase.

Commonable lands I understand to mean lands generally arable, at least in part, which belong in property to individuals who are known, and the limits of whose property are ascertained; but which, in regard to their culture and mode of cropping, are subjected to certain regulations, which custom, for time immemorial, has established, so as gradually to have acquired the force of law,—to which rules every individual occupying such property must adhere, until these old customs shall be abrogated, either by the *unanimous* consent of all the individuals having a right to these commonable fields, or by an express statute, obtained with their consent, for the purpose of annulling them.

From a bare statement of the case, it is easy to perceive that regulations, which were adopted at a very distant period, when agriculture might be said to be but in its earliest infancy in this island, and which were calculated to accord with a

state of society very dissimilar to that which now prevails, must be extremely defective ; and, in particular, that they will prove an unsurmountable barrier to every kind of improvement, wherever they are suffered to exist. Yet it is a melancholy truth, confirmed by every one of these reports, that this practice has not only been suffered to exist in every county in England, but it has been calmly tolerated to an enormous extent even till the present time, without one national effort to remove it. In some counties, it appears that not much less than one half of the whole arable lands are in this state ; although it is evident, by the concurring testimony of the whole reporters, that, taking all these lands at an average, they do not afford *half* the produce the same lands would do, if they were put under the ordinary management that appropriated farms are subjected to in their respective districts ; and not perhaps one tenth part of what they might easily be made to afford, within a very short period of time,

should all other obstructions to improvement be removed.

It would be tiresome to enumerate the whole facts that occur in the different agricultural surveys, tending to point out the extremely pernicious tendency of this mode of tenure : but a few of them may be mentioned. In one place, it is stated, that a few inclosures had been made, seemingly with the concurrence of the whole parties concerned ; but when the hedges had advanced nearly to become a fence, one of the commonable tenants went deliberately and pulled them up by the roots, and eradicated them entirely. In another case, [Bucks, p. 29.] the parishioners having come to an agreement to sow clover ; after that practice had been universally acquiesced in, for the space of 18 years, one of the farmers, occupying 16 acres of land, bought a large flock of lean sheep in the month of May, and turned them on the clover crops, which were nearly in bloom ; and no one could hinder him. In another

ease, [*ibid.* p. 30.] where custom had established the practice of having one corn crop, and one fallow alternately, the occupiers of the district came to an agreement to have *two* crops and a fallow, alternately ; but before the expiration of ten years, one of the farmers broke through the agreement, and turned his cattle upon the crops of beans, oats, and barley ; in which plan he was followed by the rest of his neighbours ; and the crops were, in consequence, totally destroyed on that part of the field, which, agreeable to the antient custom, would have been that year in fallow.

These few notices, while they tend to illustrate the nature of the particular kind of tenure here complained of, are at the same time perfectly satisfactory as to its pernicious tendency to the public ; so that it would be time mispent to adduce a greater number of proofs of a self evident proposition. No one who has considered the subject for a moment, but will readily admit, that it were much for the interest

of Britain, that no such practice existed in it; and that of course, no time should be lost in endeavouring to eradicate it. For were this effectually done, it must appear evident, from the facts stated, that the total produce of the kingdom would be greatly augmented.

Yet it by no means follows, that it would be prudent in the owners of such property, were it even at their absolute disposal, in every case instantly to abolish intercommonage. No practice can ever be universally established, by a long concurrence in opinion of a numerous body of men, which is not grounded on reason, and is calculated for their mutual convenience, under the circumstances in which they were placed at the time when such practice was established. And although it may happen, that, by a gradual alteration in the state of society, those practices which were once salutary, may become no longer necessary, but pernicious; yet it will be in general found, that when this last comes to be incontestibly the

case, the same common sense which at first concurred in establishing the practice, will in like manner at length concur in abolishing it.

From this train of reasoning, there is always room to suspect, that whenever a particular custom is loudly complained of by those who only casually consider of it, while it is acquiesced in without much seeming uneasiness by those who are more immediately subjected to its operation, there must probably be some unobserved circumstances, which perpetually come in the way as great inconveniences, whenever an attempt is made to remove the *apparent* evil. And if such inconveniences are found to arise, it will be in vain to make laws to abolish those practices; for, in these circumstances, the practice will still prevail in spite of the law, however peremptory it may be, and however beneficial in its tendency it may appear to hasty observers.

Can any thing, for example, be apparently more beneficial, or at first sight

more easy, than to enforce an uniformity of weights and measures throughout a whole kingdom? The proposition appears to be so self evident, that the Legislators of England, of Scotland, of France, and of many other kingdoms, have separately judged, at many different times, that this might be done with evident advantage to all their subjects; and laws have been repeatedly made in all those nations, as simple in their tenor as could well be expected, and as peremptory in their enactments as can be conceived; yet in no one of these countries has it been ever found possible to enforce these laws. The fact is, that there are inconveniences to which such a change would give rise, and which would be so universally felt by individuals, though they have been totally overlooked by the Legislators, that, it requires not the gift of prophecy to say, will for ever stand in the way of such an improvement, until those circumstances shall be first adverted to and obviated

Similar in kind, there is reason to suspect, must the inconveniences be that are in many cases felt, when an attempt has been made to eradicate the practice of commonable fields: for although it be true, that the difficulty of bringing a *great number* of proprietors to be unanimous in any one measure is very great, and that the expence of obtaining an Act of Parliament is such as to deter many persons from resorting to that measure, who would otherwise have been glad to avail themselves of that means, for silencing unreasonable opponents to their plans; yet there must be many cases, where a single proprietor is lord of the whole extent of commonable fields in one district, who in that case would have nothing else to do, but to allow his leases to expire; and then he has it in his power to turn out every tenant, who is not willing to accept a lease under such terms as he shall please to grant it. And where the whole of the commonable property belongs only to two or three proprietors, the same thing could

be effected with little more difficulty than in the former case, were it so obviously beneficial to all parties as at first sight it appears to be : but since we find that such measures are not generally adopted in these cases, I see still reason to suspect, that there must be some circumstances of general conveniency that stand in the way ; and it becomes of consequence to enquire what these circumstances are, in order to see whether these can be first removed, before any general law be recommended for abolishing this kind of tenure.

A person who is well acquainted with the practice of agriculture, can easily form an idea of many arrangements, under which a mutual intercommonage, at certain times of the year especially, and under particular modifications, might be not only a convenience, but even a *necessary accommodation*, without which he could not farm his lands. In all situations, for example, where the quantity of arable land occupied by one tenant is so small,

as that it cannot afford to maintain a sufficient strength of men or beasts to labour, and carry on the necessary operations upon it; that tenant must join with some other neighbour, in similar circumstances, for mutual aid and assistance. Wherever the produce of the fields are so scanty, as to require a very wide range for the beasts which pick up that produce, unless the occupier of the land be able to stock such an extent of land, as to afford to keep a person, by himself, to tend his own flocks; an intercommonage between the smaller tenants, if such there shall be upon that ground, becomes absolutely necessary. Wherever the number of cows that can be kept by one tenant, are too few to eat down the produce of any field; to avoid the necessity of frittering it to pieces, by rearing innumerable fences for very small inclosures, it will be for the mutual convenience of all parties, to have the meadow laid open to the whole of these small tenants, as soon as the hay can be carried off from it. I might go on to

Quote other particulars, in which this kind of partial intercommonage might be convenient; but those above stated are sufficient to account for the origin of commonable lands, and to show that the practice was not only necessary, at the time when it was first established; but that, under the same circumstances, it is equally necessary now, and must continue to be so till the end of time, if the state of occupation on these lands shall continue to be the same.

The fact is, a similar practice, under whatever name it may be known, must have prevailed, and must still prevail, in every country where land is parcelled out among tenants in allotments too small for the state it is in at the time to admit of, under a strict appropriation. In Scotland, it was, and is known, with this difference between the practice there and in England,—that whereas in Scotland every man's possession is, by the law of the land, declared to be his own exclusively for the time he holds it; and that of course

he can banish any person who shall trespass upon it without his permission ; a reliance being placed upon the common sense of men, and their mutual interest, as sufficient to insure good neighbourhood, and a voluntary interchange of mutual rights ; it has in England been judged to be more for the mutual benefit of the parties, to insure themselves against any infraction of good neighbourhood, by establishing general regulations for that purpose ; which were to compel the refractory to yield the unlimited exercise of his own will to the general sense of the community.

It thus appears, that if *common-field* husbandry be an obstruction to agriculture, which no considerate person will deny, this evil would not be annihilated merely by obtaining a law for its abolition. This evil in fact resolves itself into another, viz. the inadequate size of farms, which will come to be treated of under the fourth head above enumerated ; and till care be taken to obviate this difficulty, there will

be so many interests deeply affected by any proposed change in the state of *commonable lands*, that innumerable obstructions will occur, in attempting hastily to abolish the practice by law, without taking judicious precautions to guard against the difficulties that may be expected to arise.

And it deserves to be particularly adverted to, on this occasion, that however detrimental to the public at large, the practice of occupying commonable lands may be ; or however much the income of the owners of such lands must thereby be diminished ; it is a matter of comparatively small importance to the tenants, or occupiers of such lands : for to the tenant, especially if a tenant at will, or one having a lease renewable by fine upon lives, (under which two kinds of tenure the greatest part of commonable lands are occupied,) it is a matter of very little consequence, whether the lands he occupies yield, on an average, ten quarters *per* acre, or ten bushels only : for, under these circumstances,

the rent that another person would be willing to give for the premises, will always be exactly in proportion to the *free* produce he thinks he can dispose of from the lands. If the lands were rich, therefore, the occupier of the land must lay his account with paying a proportionably higher rent, or quit ; so that his actual profits may be equally great upon these lands in their present state, as if they were capable of yielding ten times their present produce. What inducement has such a man to make exertions in industry ? It is rather his interest to let things continue as they are : for this will effectually prevent spirited men, who have stock for carrying forward agricultural improvements, from ever thinking of interfering with him in a competition for his miserable farm. In this way, a proprietor who shall think of making an alteration on tenures of this sort, must frequently find that he meets with a body of *vis inertiae* to remove, which it is impossible for him to overcome. It is, as if a fisherman, in

his boat, were to attempt to move the Craken of Pontoppidon. He finds it exceeds his force, and he must finally give over the attempt as hopeless.

But though a law, which should set aside all the practice of commonable fields, could such a law be actually obtained; would not, of itself, remove the evils complained of; yet, as there may occur many cases, in which the proprietors, were they at liberty to act with freedom, would perceive it was their interest to adopt such measures, as should admit of having these, now commonable lands, cultivated in a proper manner, it would surely be a very desirable thing, if some easy mode could be devised for giving them that freedom; when they found they could avail themselves of it with propriety; while it should at the same time allow others to retain the undisturbed enjoyment of their present commonage, until a fit occasion should present itself for altering it.

In all cases of this sort, it is necessary to proceed with caution; and whenever

recourse can be had to experience, in similar cases, that ought to be consulted in preference to any preconceived idea, however beautiful, that never has been carried into practice: for unforeseen difficulties in every new case occur, which are often accompanied with very serious consequences. In the present case, we find that the same evil which subsisted in Scotland, nearly, as I suppose, to an equal proportional extent as it now does in England, has been gradually done away without violence or difficulty of any sort; merely by *permitting* every one who found it his interest to abandon the practice of intercommonage, to do so, without positively *requiring* that this in any case should be done, till some one of the parties wished for it. It is true, that in this way, it would be in the power of one man, at times, to incommode his neighbours; but it is also true, that he cannot do this without being disquieted himself, unless his situation be such as that it is much for the benefit of the community at large, that

he should exercise this privilege; and it has been found, that in practice this privilege has scarcely ever been claimed, but in these circumstances.

Now, could an act be obtained, which should put the whole tenants of the commonable lands in England, precisely in the same condition with lands occupied by the same class of persons in Scotland; it does not appear that any other consequences should be experienced in the one case, than those that have been felt in the other. This appears to be a very easy matter: For were it simply enacted, that “the
“ practice of no person occupying lands
“ in England, should be influenced by
“ the will of any person whatever; unless it were in those instances alone
“ which a tenant specifically agreed to
“ perform in his lease, any law, privilege, or custom to the contrary, notwithstanding;” the thing would be at once done. In that case, the *occupiers* of commonable lands would be at perfect freedom to continue to intercommon, as at

present, if so they should incline; but whenever any one among them found his situation such as no longer rendered this practice beneficial to him, he could withdraw himself from the association, without having any power to dissolve the connection of the rest of the community with each other, as long as they inclined it should continue in force.

We have, in Scotland, the experience of precisely such a law, in a case nearly similar to that here treated. During the course of many ages, a vast diversity of practices had been there established by custom, in regard to certain services that were wont to be performed by tenants to their lords, which were accepted in part of rent. These practices, like those of commonable lands in England, varied in every district, and parish, and barony; so that perhaps no two of them were alike in all respects: but every court of barony took cognisance of the old usages established in that barony, and all the tenants in it were bound to pay these services *according to use*

and wont. With the change of manners which gradually prevailed in every part of this island, a change of ideas took place; and, like the commonable rights in England, these services, established by *use and wont*, were generally accounted a grievance that ought to be removed. Accordingly, in the act which took away all heritable jurisdictions in Scotland, which was passed in the year 1746; a clause was introduced, declaring that all *indefinite* stipulations in a lease were entirely null and void; ever since which time, those vague terms of *use and wont* have been considered as nothing in every court of law; though services in kind, when particularly specified, are still as much accounted a part of the rent as any sums in money, or other prestations. The law proposed, therefore, would not be without a precedent, which in its execution has been found to be easy, as in its operation salutary.

With regard to the intermixture of lands which take place in these common-

able fields, in many cases, to the very great detriment of agriculture; the same thing took place in Scotland, under the name of *run-rig*; a practice which took its rise in those times of anarchy, when individuals were often marked out for destruction by other individuals; for by their mixing the property of one with another, every attack upon one became an attack upon the whole, which all of course were bound to defend. This intermixture of land respected either the possession by the tenants only, which was sometimes intermixed, while that of the different proprietors were separated; or it respected the property of the proprietors also, which were sometimes blended together in small detached parcels. Both these evils have now been remedied so effectually, that scarcely any vestiges of them are found to exist. They have been got rid of in this manner. Where the intermixture of ground was only among the tenants belonging to the same lord, he usually allowed all the leases to expire before

a renewal of any was granted ; and when the lands were thus out of lease, he divided the whole into farms, usually the same number as before, and then re-let them as separate farms. Where the inter mixture was of separate properties, very often these proprietors agreed to authorise certain persons, named by themselves, to make a fair and equitable division of the properties ; assigning to each the part appropriated for him in the situation that best suited him, or that was most contiguous, if he had other adjoining property. But if one or more of the parties stood out, and would not come to an amicable compromise ; then it was competent for any one of the parties, who chose it, to bring an action before the sheriff of the county for a division ; who, after nominating persons skilled in matters of this sort, to divide and apportion the ground in dispute, and to give in a report ; and having heard parties, and visited the ground in question himself, and seen the boundaries fixed before numerous

witnesses; the sheriff proceeded to give an award, which was final, unless, upon appeal to a higher tribunal, (which was competent,) his sentence should be altered. In divisions of this sort, I do not recollect ever to have heard of an appeal from the decision of the sheriff. It is, at the same time, so little expensive to the parties, and so well calculated for the distribution of material justice, in cases of this sort, that is not perhaps possible to propose a better model for imitation.

Were these, or similar regulations, adopted in England, there seems reason to be satisfied, that all the evils originating from the practice of *common field husbandry*, so much, and with such reason, complained of at present, would be effectually and imperceptibly removed; without any convulsion or violent struggle. If all the other obstructions to agriculture shall admit of as easy a remedy as this one, we may hope to see the improvement of the country put upon a very desirable footing, even in our own day.

§ II.

Of Commons, as an Obstruction to Agriculture.

IF *commonable lands* be complained of as a grievance, *commons* must justly be accounted an evil of still greater magnitude : and this also is experienced to an astonishing extent in every county in England. Among the distinguishing characteristics of man, the most peculiar is the faculty of observation, that has been conferred upon him by the beneficent Creator of the universe. By means of this faculty, he is enabled to compare together facts that fall under his observation ; to reason upon these ; and to draw conclusions from them that tend to accommodate himself. It is by this means he has been able to discover, that a soil, which in its natural state is perhaps incapable of producing almost any of those things that are necessary for his subsistence, may be so managed as to

be made to yield abundance of the most delicate products of the earth: nor is it possible to set any limits to the encreased fertility that a continued industry, under the guidance of reason, may confer upon even the most infertile soil. It was by means of such exertions, that Palestine of old, from being one of the most infertile regions on the globe, had become, in the strong language of the scriptures, a land flowing with milk and honey; and was capable of then supporting within itself, a population at least an hundred times greater than it can do in its present state; after it has been suffered to revert to its original condition merely by withdrawing the industrious exertions of man. There are many instances, in our own country, where a field has been, in the course of a few years, made to yield a thousand times its original produce. But in a country where commonage universally prevailed, this favoured gift would have been conferred on man in vain. He can then only trample under foot a forlorn

waste, which, though it possesses the capability of being made to afford him innumerable comforts, he is effectually barred from indulging the cheering hope of being ever permitted to enjoy. He is indeed debarred from ever being able to ameliorate the soil, and thus to augment its product to the State; but he is not prevented so effectually from deteriorating it. While in the state of a common, the surface may be broken by him in such a way, as not to recover for ages a sward equal to that which was originally upon it. It may be cast up and sunk: It may be converted into wet and rotten marshes, by casual obstructions being thrown in the way of the water: which no one finds it his interest to remove: It may in short, while a common, be abused in a thousand ways, by reason of his obstinacy, indolence, or caprice; but it never can be benefited by his industry: and not only *may* this be done, but these things actually *are* done, in innumerable instances, in this land of freedom; so that

to a person who contemplates the loss that the nation must sustain by these deplorable abuses, nothing can afford a more melancholy train of reflections, than the frequent recurrence of those disgusting commons suggest to his mind, as he travels over that, otherwise delightful, country of England.

When he stops to enquire more minutely into the effects of this kind of property, upon the morals and domestic economy of the individuals who claim a right to these commons; he only finds additional causes for regret. He frequently discovers, that the quiet and industrious cultivator, having a right upon a common, is obliged to abandon that right, because of the harrassments to which he is subjected from turbulent and assuming neighbours; who have obtained a small footing there, with a predetermined resolution, perhaps, to encroach much farther than their rights would authorise; because they know that, towards the restraining of these excesses, no obvious and easy

means occur. Thus does the peaceable man often find it better to relinquish his right almost entirely, than be subjected to the perpetual contention that would occur in defending it. In consequence of this, he frequently finds that the small flocks of the poor cottager, who cannot afford to look after them continually himself, are so tormented, by being chased from place to place by those marauders, that, instead of a relief to the poor cottager, these flocks prove only a torment to him: his family becomes in consequence of this, a burthen on the parish, which is obliged to support them: He finds, that among those who are bred up in these situations, there are many young men who delight more in active plunder than in sober industry; and who, tempted by the high prices that luxurious inhabitants of towns offer for game, become poachers; and form such powerful confederations of determined profligates, for their mutual protection, that no one less determined than themselves will dare

to interfere with them ; which enables them to carry on their depredations with impunity. He observes, that the money these young men thus acquire, is usually squandered in drinking and riotous excesses. The young women are contaminated by their conversation, corrupted by their excesses, and debauched ; the least evil attending which courses, is a great number of illegitimate children, and an extravagant poor rate. But who can estimate the detriment that a nation sustains, when the morals of the country inhabitants of it become corrupted ? It is like tainting the springs of water with poison, which, instead of promoting health and vigour, as they naturally ought to have done, produces one universal mass of infectious disease.

It is common to read in the history of Britain, that the *rot* among sheep became, at times, so prevalent in England, as to carry off many millions of sheep at once ; and these diseases are regarded, like the pestilence among the human species, as a

terrible visitation of Heaven, for the sins of a guilty land. There is great reason to believe, that these frequent mortalities among the flocks were entirely occasioned by the numerous commons, which were in those times much more extensive than at present: for it is still known, that in neglected spots, where water is allowed to stagnate and generate marlhes, as is often the case with commons, when the season proves wet; the sheep pastured upon them are, to this day, so much subjected to the rot, as to induce many persons rather to give up their right, than to allow their flocks to enter upon these unhealthy pastures. Considered under every possible point of view, then, it appears to be undeniable, that the prevalence of commons is a great national grievance, which ought, if possible, to be removed; and that the Board of Agriculture cannot be more beneficially employed, than by granting all the aid that their wisdom can devise, for removing those bars that at present tend

to prevent the equitable division of this kind of property.

As to the *extent* of these commons in Britain, facts are still wanting to ascertain it with precision: nor is exact precision in that case absolutely necessary. From every one of the agricultural surveys yet made, it is evident, that in every county in England and Wales, there are extensive tracts of land of this description, (for *commons* and *wastes* may be considered as nearly synonymous terms, although it be a truth, that many of these commons consist of land naturally as good as any in the kingdom.) The President of the Board of Agriculture has given a slight view of the estimated extent, and probable improvement of which these lands would be susceptible, if divided. Of the extent of these lands, were it necessary, a tolerably accurate knowledge might be attained; but as to the amount of improvement, it is impossible for any person to form at present an idea of it, should the prosperity of this country *be permitted* to

go forward, for a considerable track of time, in that accelerating *ratio* into which it would naturally fall, if the general tranquility of the nation shall be preserved; and the other obstructions to be mentioned in this Essay, which have hitherto repressed exertions in agriculture, be removed. It is enough here to say, that it would be an object of immense magnitude. I have already had occasion to observe, that in some favourable situations, it is well known that land, in the course of a very few years, has been made a thousand times, at least, more productive than in its original state. Many commons are at present lying waste, in situations equally favourable as these: and many other situations may become equally favourable, by an extension of those modes of facilitating intercourse, which are now in contemplation; and are only prevented from being carried into effect by barriers that judicious laws may easily remove.

The origin of commons may be traced to the same source with that of commonable fields; viz. an inadequate size of individual possessions: and so long as this mode of parcelling out lands shall continue, those having a right to commons, will have the same objections to a division of them, as the tenants of commonable lands must have; with this difference, however, that some individuals among those having a right of commonage, being much more conveniently situated for availing themselves of that right, than others equally entitled to it who live at a greater distance, it must of course be the interest of the first to oppose any division of the common, which can be supposed to have justice for its basis. To require then, as the law at present, if I am rightly informed, actually does, an *unanimous* consent of all the parties concerned, (were minors and fatuous persons out of the question,) before a division can take place, unless under a special Act of Parliament, obtained expressly for that purpose, is nearly

the same thing, as saying, that no division of a common can take place, without a special Act of Parliament for that purpose.

There are three circumstances that have hitherto tended greatly to retard the division of commons in England. These are, *First*, the great expence that must, in most cases, be incurred, before an Act of Parliament can be obtained for the division of a common. *Second*, the difficulties that occur in setting just bounds to the claims of the lord of the manor, and the tithe owner. And, *Third*, the expence that necessarily must follow such division, in consequence of the general practice that has hitherto prevailed, of obliging every one of the owners of such divided property, immediately to inclose their respective shares, even where the circumstances are such, as that a prudent economy would not permit the effecting of such inclosures: but much the reverse*.

* In treating of the improvement of waste lands, this subject will be resumed; and the circumstances pointed out, which render it impossible to compel an inclosure,

Were these three obstructions to be moderated, or totally removed, much good would result from it: nor does it seem to be impossible to do this.

In regard to the *first* circumstance, the expence of obtaining an Act of Parliament for *dividing*, which I would wish to substitute for *inclosing* of commons, this, I am assured, in all cases, amounts to such a sum, as to exceed the whole present value of many small commons, were they fairly sold by open auction. Of course, all such small commons, which, though they may be of little value *individually*, would be of great national concern *collectively* considered, are doomed to remain in the state of *wastes* till the end of time; if no mode shall be devised for removing this bar to their division. In intricate cases, or where some of the parties concerned are wealthy and obstinate, I am assured that the actual expence incurred

wherever a division of waste lands takes place. The reader is referred to that article for farther satisfaction on that head.

before an act has been obtained, for authorising the division of a common, has amounted to the enormous sum of several thousand pounds. With the dread of even the chance of any thing like such a charge being incurred, it is easy to see, that many owners of such commons must feel a great reluctance at taking any steps that might eventually subject them to such an alarming expence, before they can be permitted to begin to improve their own property.

In regard to the lord of the manor, who has sometimes a very small claim in other respects upon the common lands, his single negative, in the present state of our laws, if I be rightly informed, proves an absolute bar to every attempt of this kind; so that if this man should be capricious and obstinate, he may prevent such a salutary measure from being carried into effect; even though all the other parties concerned should be unanimous for it. (In regard to incapacity or nonage, I do not know how the case stands in this re-

spect.) And in respect to tithes, I know of no method that has yet been devised for satisfying this demand; but that alone of obtaining the consent of the tithe owner, to agree to accept of such a specific sum in money, or such a proportion of the land itself as shall content him, *in lieu* of tithe, where the tithe is claimed by the clergy, so as not to be liable to future challenge: nor can even this be done, unless under the sanction of a special Act of Parliament: so that if these men shall prove greedy, capricious, and obstinate, a great deal of expence must be incurred before their claims can be settled; the dread of which must also operate, in many cases, to prevent a division of this kind of property.

How these different obstacles are to be removed, will require the mature deliberation of the Honourable Board of Agriculture, and the Legislature at large. But the object is of such consequence, as to demand their most serious attention. With a view to pave the way for such delibera-

tions, I shall beg leave, with due deference, to submit to their consideration such hints as have occurred to me on this subject, after the most careful attention that I myself have been able to bestow upon it, aided by the suggestions of several men of sound understanding, who are well acquainted with things of this nature, with whose opinions I have been favoured.

I have found it to be the general wish of every person with whom I have communicated on this subject, that one general Act of Parliament should, if possible, be obtained, under the authority of which all commons might be divided; without the necessity of applying for a separate act for the division of each individual common. Nor does the thing seem to be at all impracticable *. Under the autho-

* The reader will please to advert, that this Essay was written in January 1795. Since that time, it was submitted to the inspection of the Board of Agriculture; and I am happy to observe, that the President of that Board has now (January 1796) actually proposed to bring in a

rity of just such an act as the gentlemen in England seem to wish for, I find that nearly all the commons in Scotland have been divided, in the space of 130 years past, with little expence or trouble to the parties; so that a common, in that country, unless it be precisely those that are excepted by this act, is scarcely now to be found. I cannot help remarking, in this place, as a circumstance greatly in favour of the measure proposed, that the same idea occurred to many individuals, who had in England separately considered the subject; none of whom knew that such an act as I am now about to quote, had ever had an existence; or were in the least acquainted with the manner in which it had operated. The act I allude to is so short, so simple, and so comprehensive, that I shall hope to be excused for quoting it entire. This act was passed in the year 1665, and runs *verbatim* thus.

bill nearly on the same terms here specified. I hope it will be attended with success. I give the Essay here as it was originally written, with scarcely a single correction.

" All commons, excepting those be-
 " longing to the King in property, or
 " royal burghs in burgage, *may* be divid-
 " ed at the instance of *any* individual hav-
 " ing interest, by summons raised against
 " all persons concerned before the Lords
 " of Session, who are empowered to dis-
 " cuss the relevancy, to determine upon
 " the rights of the parties concerned, to
 " *divide* the same amongst them, and to
 " grant commission for perambulating,
 " and taking all other necessary proba-
 " tion, to be reported to the Lords, and
 " the process to be ultimately determin-
 " ed by them; declaring, that the inter-
 " est of the heritors having right in the
 " common, shall be estimated according
 " to the *valuation* of their respective lands
 " and properties; [having right to that
 " common,] and that a portion be adjudg-
 " ed to each adjacent heritor, in propor-
 " tion to his property, with power to the
 " Lords to divide the mosses, if any be in
 " the common, among the parties hav-
 " ing interest; or in case they cannot be

“ divided, that they remain in common,
“ with free ish and entry, whether divid-
“ ed or not.”

No eulogium can be too high for the comprehensive clearness of this short act; which is in no respect liable to ambiguity or misconstruction of any sort. The consequence has been, that in its application it has been the most easy and satisfactory to all parties that can be conceived. It puts it in the power of *any* individual having interest, to *force* a division of a common, whenever he shall find it suits his own interest, by a very simple process, that can be raised at a trifling expence. It puts it in the power of every person concerned, to bring forward their just claims; and prescribes an undeviating rule by which they are to be adjusted. And, finally, it allows every person to use the property that shall be thus awarded to him, in that manner which shall seem best calculated to promote his own interest, without limitation, or restraint.

In regard to *inclosing*, the general law of the land is allowed to apply here as in every other case. The law in Scotland respecting inclosures, is, that if any one chooses to inclose his property, he can *compel* the adjoining proprietor, by means of a process raised before the sheriff of the county, to streight marches, where necessary, at the sight of the sheriff; who must perambulate the marches, and settle the line, if the parties do not agree upon it themselves; and to make each party bear one half the charge of a common march fence. The sheriff also is to prescribe what this fence shall be, if the parties disagree; which fence is to be upheld in all time coming, at their mutual charge. This is the practice by those who choose to carry the law to its utmost rigour. But the general practice is, (and what I humbly conceive *ought* to be the law) that if one of the parties wishes to make an inclosure for his own convenience, one side of which runs along the line of the march, while the adjoining proprietor has no in-

tention of *there* making an inclosure at all; in that case, the *first* erects the fence that runs along the march, entirely at his own expence, as well as the other fences round his field: nor does he claim any part of that expence from the adjoining proprietor, until the proprietor avails himself of it, by making it a part of the fence of an inclosure made on his side also; at which time, and not before, he pays to his neighbour the half of the original expence of rearing that fence, and is at half the expence of upholding it ever afterwards. This is also the rule adhered to respecting partition walls, that mutually belong to adjoining buildings; and seems to be consistent alike with the strictest equity and good neighbourhood: and it would be doubtless attended with very good effects, were this rule adopted universally in England, with regard to all inclosures to be made, whether on commons, commonable fields, or otherwise.

Though the law above quoted was perfectly applicable to the state of common

lands in Scotland, at the time it was made : yet, as there are some peculiarities respecting commons in England, that did not there prevail ; in an act to be obtained for the same purpose in England, provision ought to be made for these circumstances. The seigniorial rights claimed by the lord of the manor over commons in England, never seems to have been exercised in Scotland ; and therefore they are not attended to in this act. A common, in Scotland, seems to have been considered merely as having been originally produced by a tacit agreement between the adjoining proprietors of land, to allow a certain proportion of their fields to be pastured and otherwise used, *in common*, for the mutual convenience of their respective adjoining tenants. It seems to be understood, that no one of these proprietors gave up the right to any part of his property, in consequence of throwing it common ; but merely admitted of intercommonage for pasturage, or other purposes of mutual accommodation to the

tenant. It was therefore understood, that no person but the adjoining heritors, or their tenants, had any right whatever to the common; nor even that these proprietors had any claim upon these commons, except for so much of their lands only, as had a right of commonage upon them by immemorial practice. On these principles, the law has been constructed, by which each proprietor is entitled to resume the whole of the property, it was supposed, he had only confounded with that of others for a time. In England, ideas of another kind, respecting the original property of commons, seem to have prevailed. The whole property of the common appears to have been conceived originally to belong to one person, who allotted to his own tenants, or the holders of his own lands around the common, or to others whom he chose to tolerate upon it, a right to have the same use of the surface produce of the common, as a tenant usually enjoys of their lands; or other partial use of it only; without giving up

his exclusive right to the soil itself; or to mines or minerals under the surface: That in setting off the adjacent property which had a right on the common, either in whole, or in part, he gave off with each parcel of land so alienated, the same right, and no more, upon the common, that his tenants on that parcel of land formerly enjoyed; and that of course he himself still retained his seignorial rights over the whole as before. In consequence of which, we find, that there are two separate interests to be adverted to in the division of a common in England, that were not known in Scotland, which will, of course, require to be adverted to in any general law that shall be made for dividing commons in England. These are, the lord of the manor, and those persons who by mere occupancy have acquired, by prescription, a kind of right that the law considers as valid; though in no way connected with a separate possession of land, beyond the bounds of the common itself, and still in

no wife affecting the feignorial rights of the lord of the manor over the whole.

There is yet another interest, that was not recognised as affecting common lands in Scotland, at the time the above act was made, which ought to be attended to in England; viz. that of the person claiming a right to the tithe. In Scotland, every common was considered as an appendage to, and a constituent part of two or more farms that lay contiguous to the common; and that of course the rent of these farms were higher or lower, in proportion to the benefit the tenant derived from the common. And as the tithes in Scotland are all, by law, liable to be converted into a fixed sum, according to a certain *ratio* prescribed by that law, *in proportion to the rent*, it followed, that when the proportion of the common belonging to each farm, was ascertained and allocated in severalty to that farm, it did not materially alter the case in regard to tithe; and was not to be separately adverted to. In England, where the tithe is usually

drawn *in kind*, and where the tithe-owner claims a right to draw tithe for even all the produce that has been created by the joint exertions of industry, and outlay of capital, it becomes necessary, if that tithe is to be abrogated, to make a provision for this interest also. Instead of the clause in the above act, which runs thus ; “ declaring that the interest of the heritors “ having right to the common, shall be “ estimated according to the valuation of “ their respective lands and properties,” a clause to this purpose may be introduced ; “ declaring, that the feignorial rights “ of the lord of the manor shall be preserved : The rights of the tithe-owner “ preserved, either by an adequate allocation in money, or a proportion of “ the soil ; the quantum of either money “ or land to be appropriated *in lieu* of tithe, “ to be ascertained by a jury of respectable men in the vicinity : And the “ surface right to be divided among all “ the other parties having an interest in “ it, according to the valuation, (or the

rent, or the value they are put at, according to the estimation of a jury, as the one or other mode shall seem most eligible, when the bill is under discussion,) “ of the respective lands and properties “ they hold, having a right to the common.” Something to this effect seems to be all that is requisite to adapt the act, *mutatis mutandis*, to England as well as Scotland. Should it be thought more eligible by the parties, to abolish the feignorial rights entirely, on the division of the common, perhaps it might be well to leave it in the option of the parties, at that time, either to purchase that right by a sum of money, the quantum to be ascertained by a jury, or to leave it entire, as should prove most agreeable to the parties: but unless three fourths in value of the proprietors, at least, exclusive of the lord of the manor himself, shall concur in a desire to purchase the manorial rights, it shall not be competent to compel a sale of them.

Were a law to this effect obtained, *authorising*, though not *requiring*, the immediate division of commons, with little expence to the parties concerned, it is not to be doubted but in a few years most of the commons in the kingdom would be divided, and gradually brought into such a state of cultivation, as would very soon make a great addition to the annual produce of the kingdom, without encroaching on the rights of any one.

§ III.

The minute Division of Property a cause of the Retardment of Agriculture.

THE evils that result from this source will be so fully pointed out under the articles, *Roads; Canals, and Irrigations*,* that little remains to be here said; beyond referring the reader to these chapters. Indeed, it requires but a very slight degree of consideration, to perceive, that wherever property is much divided, the bars to any measure of general utility that shall be proposed, must be multiplied to an astonishing degree.

The tenure called *gavel-kind*, which implies a division of all the landed property a man holds, in equal portions among his children; though it seems to be, at first

* Those chapters are nearly ready for publication, and will probably be submitted to the public, as soon as convenience will permit.

fight, a very just and equitable institution) seeing it is an obvious truth, that all the children of any man have an equal right to his care and kindness, and consequently, to an equal share in his property: yet here, as in many other cases, this law of strict equity in speculation, appears to be, when rigidly applied in practice, highly injurious to society; and had not means been invented to counteract this law of *justice*, as some would call it, the property of this island would have been divided into such parcels, long ere this time, as to have proved a total bar to the cultivation of the soil in any way. For example, suppose a man to be possessed of one hundred acres of good land, worth one pound an acre *per annum*; which is one of the most favourable cases that can be supposed to admit of a small division of property: And let it also be granted, that three children, on an average, may be produced from each marriage. This hundred acres would, in the first generation, be divided into lots of thirty

three acres each, omitting the fraction; in the second generation, the lots would be eleven acres; in the third, three acres and a fraction; in the fourth, one acre each; in the fifth, 59, say 60 falls; in the sixth, 20 falls; [poles] in the seventh, 7 falls nearly; in the eighth, $3\frac{1}{3}$ falls, or 66 yards; in the ninth, 22 yards; in the tenth, 7 yards nearly; and in the eleventh, two and one third yards. Thus, in the course of eleven generations, each man's property would be barely sufficient to make a grave to hold himself. In this case, it might truly be said, that *summa jus* is *summa injuria*. Supposing it were possible to make these divisions without disputes and heart-burnings: Supposing charters, for defining these, could be obtained without expence, (neither of which we know could possibly take place, and either of which would be productive of unsurmountable inconveniences,) yet still this would be a small evil, compared to those that follow: No inclosures could be made, no ground could be plowed, no cattle could

be grazed ; nothing would remain, but for each man to lie down and die upon the small spot he claimed as his property.

Instead of that excess of *speculative* justice, the wisdom derived from *experience* has happily remedied all these evils, by departing from the idea of chimerical *rights*, that can in no case be ever exercised, and adopting another rule, which, though it appears, at first sight, to be grounded on injustice, has been found to be dictated by wisdom. The law of *primogeniture* *, which prevents landed property from being frittered away into such small portions as would render it useless, while it enables the father, by burthening the eldest son with the payment of such sums out of it, for younger children, as he sees expedient, puts it in the power of

* The reader will here advert to the difference between the law of primogeniture, and the law of *entail*, which, by appropriating the whole property unalienably to one, is productive of the most destructive consequences to a society of men who are engaged in projects of industry.

every owner of land, to make as minute a division of his territorial property as he may think proper, without cutting it into pieces. The consequence is, that when these portions of land become too small to admit of being usefully divided, the whole of the property must be sold ; and so this unwieldy mass, by passing to another person who has funds abundant for the acquisition of it, throws into the hands of those whose substance was too mean to allow them to make a *proper* use of that kind of property, another kind of property, *cash*, which can be applied in a thousand ways, in the most minute proportions, towards exciting energy in exertions of industry. This is one of those few political institutions, which, on account of the unconstrained tendency of its operation to promote the public weal, somewhat resembles, in this respect, the beneficent operations of nature, though it seems to run directly counter to that ideal perfection which, to the disgrace of the *learned*, has assumed, among

the philosophers of the present day, the place of common sense, by substituting ideal phantoms, instead of well authenticated facts, as a basis on which all reasoning concerning human affairs should ultimately depend.

§ IV.

Intermixture of Property an Obstruction to Agriculture.

WHATEVER tends to divide landed property into very small patches, necessarily tends to throw it in time into the most awkward state of intermixture, many instances of which occur in a variety of the surveys. Suppose, for example, a field, consisting of ten acres, or ten ridges, was divided among ten children; and that these portions were laid off in the most regular order; no one person having any part of his property disjoined from any part of what belongs properly to him-

self; but the youngest, we shall suppose, chooses to sell his share to the eldest. Here the eldest becomes possessed of two acres, or ridges, one at each side of the field, without having any part of the intervening property. If he should get still richer, and should purchase another share from some of his other brothers, he thus gets three bits of property, all of them detached from each other. So on, the evil may be encreased in *infinitum*. Something of this nature must be accounted the origin of those little patches, called *flangs*, in Wales, so often to be met with, lying scattered in the midst of another man's property, to the total obstruction of all improvement, and the perpetual annoyance of the neighbourhood, wherever they take place.

It would, perhaps, be using too free with the private property in this island, to say, that it should be ordained, that wherever a patch of ground belonging to one person, not exceeding acres, which is supposed to be the lowest size of a field

capable of proper culture, was found lying in the midst of fields belonging to any other person; in that case, it should be competent, upon a proper application, for a court of justice to compel that person, either to sell that property to the owner of the surrounding land, at a price that should be deemed a fair one, by an unprejudiced jury; or to accept of land *in lieu* of it, that should, by a jury, be deemed of equal value, lying at one side, contiguous to some road, or other convenient boundary, that should not necessarily tend to interrupt the proper culture of the fields: yet, a man of an upright mind, who had the public good only in view, without regarding private prejudices, would hardly perceive any valid objection to such a law; especially if it should give the holder of such interjected property an option to choose the one alternative, after he had seen the determination of the jury in regard to the other: that is to say, when a price had been assigned which he judged inadequate, he

should be permitted, in its stead, to choose an allotment of land, or *vice versa*. But if, with all these limitations in favour of the holder of small property, the above measure shall not be deemed expedient, I must leave it to the wisdom of Parliament, to devise one that shall be less exceptionable. For this evil so much prevails, especially in the distant and unimproved parts of England and Wales, as loudly to call out for a remedy, if the effectual improvement of the country be seriously intended.

§ V.

Mills considered as an Obstruction to Agriculture.

THE practice of irrigation, with a view to promote the fertility of the soil, and counteract the backwardness of the climate, is already pretty well understood in a few districts, where it is known to be the greatest and the cheapest improvement of land that has ever yet been discovered. And as the knowledge of it will quickly, it is hoped, be now communicated to all parts of the country, there can be no doubt but it would be soon *universally* adopted, to the unspeakable advantage of the nation, were it not from the opposition that owners of mills, in all cases, make to the diverting the water from its ordinary channel, for an indefinite distance above them, even where the property of the ground through which

the water flows, is not their own, or where it returned into its former channel before it reaches their mill; alledging that they have a servitude for the use of the water; and that whatever diminishes the quantity of that water, if it is at any time scanty, is a manifest abatement of the value of their property, which they consider as not to be allowable: not advert- ing that the same argument, to perhaps a much greater amount, might be adduced by the others. And as, at the time that water-mills first came into use, they were judged to be a very great national improvement; those who erected such were encouraged in these laudable attempts, by many privileges and immunities conferred upon them: and in all cases where disputes arose respecting mills, the most favourable construction possible was put upon every circumstance that affected the owners of them. In consequence of this, a body of decisions, favourable to the claims of mill-owners, might be found, so formidable, as to deter

any man from thinking of engaging in a law suit with them. These circumstances have given to the holders of water-mills a preponderance in the scale of property that they ought not to enjoy: And the time has long since been arrived, when these indefinite privileges ought to have been restricted and defined by law; which becomes every day more and more necessary, now that canals for internal communication, and for irrigation, are called for universally; and, in many cases, are entirely interrupted by the obstructions that this circumstance throws in the way. Nothing can show more strongly, than the present case does, the necessity that there is for reserving a power in Parliament to remove obstructions that the laws themselves, from a change in the circumstances of the country, may have thrown in the way of improvements; or the futility of the reasoning of those who contend, that *justice* requires, that in every case, where the law has authorised or encouraged a certain practice, it is incompetent

for the Legislature to interfere ever afterwards, in restraining, new modelling, or in any way curtailing these practices. If Legislators act to the best of their knowledge, according to facts established at the time the law is made, so as best to promote the public weal, they perform all that can be required of them ; but if facts shall be afterwards discovered, which show, that these well intended laws come, in time, greatly to retard, instead of promoting the general prosperity, would it not be absurd to say, that those evils must not be removed, which a change of circumstances has brought to light? At the time water mills were first introduced and encouraged by the Legislature, the use of water, for the purposes of irrigation, and of constructing internal canals, was entirely unknown : neither was it conceived to be possible to turn machinery by any inanimate moving power, either so great or so steady as water ; so that the turning of mills may, at that time, have been considered as the most useful national

purpose to which water could be applied. That this is not the case, even in the present state of our knowledge, admits of the clearest proof. Let it be supposed, (which will scarcely be denied) that an ordinary mill-stream, including, on an average, the whole distance of run appropriated to that mill, should be sufficient to irrigate one hundred acres of land; it is admitted, by all those who are in the practice of this mode of improvement, that, merely by this means, land, which was not worth more than five shillings, will, in the course of a few years, be made worth three pounds *per acre per annum*. Let us for the present say, that the land was meliorated to the rate of forty shillings *per acre*: In this case, the mill stream would be worth to the public, or to the owner of the land, which is the same thing, two hundred pounds *per annum*. But it is believed, that, taking all the mills in the kingdom, the average rent afforded for them will not exceed twenty pounds, after deducting repairs, and every other colla-

teral expence conjoined with them. Thus is the public subjected to a loss of no less than one hundred and eighty pounds a year by this mill.

Nor is it necessary that the public should be deprived of the benefit of the mill, even if the whole water should be abstracted from it. For, in most situations, the mill could be worked by steams, nearly as cheap, and certainly with as great effect as by water. It would seem, therefore, that in balancing the case between two claimants for water; one who was to employ it for the purpose of irrigation, and the other for the use of a mill, there can be no reason to hesitate on which side the public weal would require the decision to be made: because, in the one case, the public is not only deprived of a benefit to a much greater amount than in the other; but also, because that loss can be made up by no other device yet known; whereas, in the other case, the loss sustained by abstracting the water, if incurred without any abatement,

is comparatively very small ; but also, that loss may be easily averted almost entirely, by a substitute that can be put in its place *.

These observations are thrown out, merely for the consideration of the public, without any intention of desiring that the plan they would suggest should be adopted. But without going these lengths, it is humbly submitted to the public, whether, from these and other considerations, it ought not, among other things, to be enacted, that in every case where an opposition is made, by the owner of a mill, against any person employing the water for the purposes of irrigation, or navigable canals, that he should have no power

* That the public would be often more benefited, by employing steam as a moving power, in preference to water, is obvious, from this single consideration ; that where water is the moving power, the peculiarity of the situation necessarily induces a great expence of carriage, which might be saved by a steam-mill being placed in the most convenient situation. Those who advert to the amazing extent of the produce of our fields that is consumed by beasts of burthen, will not think lightly of this consideration.

to stop them, until he should previously have established the following facts by the determination of a jury, and the sentence of a judge consequent thereon; viz.

1st, That the machinery of his mill is constructed upon such principles as admits it to perform the greatest quantity of work, with the least expenditure of water: And,

2^{dly}, That the quantity of work he has been in the use to perform for five years back, on an average, has been such, as, upon the best construction of the mill, would have required a quantity of water, though no part of it had been allowed to run to waste, equal to the whole that the stream in question could afford. And in case he should fail in these points, and it should be found that his mill, from her faulty construction, or improper position, required more water than was necessary; or that he allowed it, through carelessness, to run to waste; he should, in these cases, have the exact quantity of water ascertained, that would be sufficient, with

a mill properly constructed, and where none of the water was suffered to run to waste, to perform, the work he had been in use to perform as above; which quantity of water he should have a title to claim from those who diverted the stream for the purposes above named, and no more.

A law to this purpose, it is humbly conceived, would prove highly beneficial to the country; as it would tend to bring a great many disputed points to an amicable compromise, which must go before Parliament at present: for, in the circumstances above stated, neither the miller, nor the person claiming the water, could be *certain* of carrying their point if it came to be litigated; unless in a case where it was very obvious that one of the parties acted unjustly: But where both parties wished *bona fide* to benefit themselves only, without doing material injury to the other, they would find it their interest each rather to yield a little to what he thought the *strictest* equity ought to

grant him, for fear that, in the event of a dispute, he might perhaps be cut off with less. Thus insolence on both sides would be repressed; and that irritation of mind which such a conduct never fails to inspire, would not be felt; so that the parties would come more kindly together, than when one of them thinks the law views him with a favourable partialty, as at present.

§ VI.

Farms, of a size inadequate to the circumstances in which they are placed, considered as an Obstruction to Improvements in Agriculture.

Few questions have been more agitated of late years than that which respects the size of farms: but these disputes have been carried on chiefly by persons who were little acquainted with the practice of agriculture, and who were of course unable to judge of the circumstances in which

a large or a small farm may become necessary for the arrangements of a judicious œconomy ; which circumstances have, in these performances, been often entirely disregarded. In general the disputants have arranged themselves into two parties, the one of which has argued in favour of *large* farms universally ; while the other has insisted, with a still greater degree of eagerness, that large farms have been the cause of every evil that these persons were capable of perceiving ; and that no salvation remained for the country, but the subdividing these farms, and reducing them once more to those narrow limits which, in their imagination, was the cause of innumerable benefits to our predecessors, that we in the present age are not permitted to enjoy.

It is not my intention to arrange myself under the banner of either of these parties. There are undoubtedly circumstances which admit of land being cultivated in the most œconomical manner, for the purpose of affording human suste-

nance, when it is divided into very small allotments; there are others in which a farm can never be managed with economy, unless where it is of very large extent; while there are other cases, which require an intermediate extent of bounds, of many different sizes: nor can the country be ever improved to the utmost extent of which it is susceptible, until these cases shall be discriminated, and the farms universally apportioned nearly to the circumstances that the case requires; but it would require a long treatise to enter minutely into this investigation. All that can be attempted at present, is, merely to give an out-line view of the principles that may lead the mind into a train of discriminating the particulars necessary to be adverted to, before a judicious allotment can be made in cases of this sort.

In the essay "*On the improvement of waste lands,*" it will be made manifest, that in scarcely any possible situation can these lands be brought into a proper degree of

culture, unless where they are laid out into large farms, or annexed to such ; and under the heads, “ commonable lands,” and “ commons,” in the present essay, it has been shewn, that both these pernicious practices derive their existence from an inadequate smallness of farms ; and can never be abolished in a proper manner, till this injudicious partition of land shall be abandoned. The reader is referred to these places for farther satisfaction as to these cases.

In every case where land is poor, and stands in need of lime or other extraneous manure, before it can be fertilized, the farm must be of such extent as to admit of keeping a sufficient number of beasts to labour it in a proper manner,—of sheep, or other domestic animals, in such a quantity as to allow of their being managed in a proper and oeconomical manner ; so as to admit of their dung being applied with effect for the production of future crops. To do all this, requires a very large capital : and a man who has a

large capital, has a right to expect, and he must have, a comfortable subsistence to himself and family, or he will abandon that occupation. But such a sum, as would be necessary for all these purposes, can never be gleaned from a small extent of the surface of *poor* land. If ever such land is to be *farmed in a spirited manner*, so as to admit of its being rendered more productive than before, or, in other words, *improved*, it must be let out into allotments of a very considerable size: and happy may the proprietor of such lands be, when he can find a tenant of spirit, with an adequate stock, who is willing to sit down upon them; for then, and not till then, it can be put into the train of a gradual and progressive amelioration. If it shall continue in small allotments, as it has hitherto done, the tenants must continue a poor and dispirited race as heretofore, and the land must continue also in a hopeless state of eternal unproductiveness; for every effort to excite a spirit of industry among men in these circumstances, must

prove abortive. I specify no particular case of this kind as an illustrative example; but refer to the cases, wherever they shall occur under this predicament, now and at all future times, as invariably illustrative of this important fact, which has been but too long disregarded in this nation.*

* I know no exception to this rule; unless the following practice, which the beneficence of Mr George Dempster, so well known in this country, suggested to him, be considered as an exception. In an estate in one of the highland counties of Scotland, that lately came into his possession, and on which, as is usual in those districts, there was much uncultivated land, and many persons who had little employment; he, with a view to encourage some industrious exertions on their part, agreed to give full permission to each person, who should settle on any of the waste lands belonging to him, for a cow to go on these; and also to cut fuel in his mosses, and to cultivate as much of the land as they should think proper; giving them a perfect security of possession, free from rent, during the natural life of the original settler; and, on the demise of the first settler, a continuation of possession by his heirs for years more, at a rent to be fixed by two neutral persons to be mutually chosen by the parties; with some other small bounties, unnecessary to be here specified: And he has now the satisfaction of seeing a great many small

If poor ground, even where no natural obstructions stand in the way of its cultivation, requires for its mere cultivation alone, a large capital and considerable ex-

patches of land cultivated along the waste, and more coming gradually into culture.

This is a fine object for benevolence to delight in contemplating; but the unceasing exertions of a beneficent owner are necessary to be continued, or the industry must slacken. In few situations, perhaps none, could the exertions of men in these circumstances be sufficient to maintain their families, even without paying any rent. Where they are furnished with employment so as to enable them to earn as many days wages as they incline, they will be enabled to benefit themselves by their own exertions upon their little field. This employment Mr Dempster has furnished them, by setting on foot certain manufactures in their neighbourhood for that purpose. The ground in this case comes to be cultivated in consequence of the manufactures: and, in a few particular situations, this may become practicable; but situations of this kind are so rare, and the requisite exertions of the proprietor so great, though, perhaps, under judicious management, not extremely expensive, that its influence must always be confined to such narrow bounds, as scarcely to deserve to be taken into the account as a national object: neither can it be considered as *farming*, in the strict appropriated meaning of the word. All the observations in the text, it is evident, respect land under the management of a *farmer* properly so called.

tent of surface. This becomes still more necessary, where considerable obstructions of another sort are to be surmounted. Where large stones require to be removed—the surface to be freed from obstructive inequalities, and rendered even for cultivation; and where draining, at a great expence, must preclude every other effectual improvement,—capital becomes still more requisite, and spirited exertions indispensable. These impediments, indeed, can never be removed without it. And to expect to find that the miserable holders of *small* farms of such land can ever be induced to make these necessary exertions, is nearly equally hopeless, as it would be, to expect to gather pine apples from thistles, or the fruit of the bread-tree from brambles.

Arable land, when even of a good quality, that has been at some former period brought into good order, cannot be so managed as to be kept in that state, and be made to yield nearly its greatest *quantum* of free produce, unless it be let off in

allotments, though of a smaller extent of surface than in the former case, and requiring a less extent of capital; yet they must still be in the class that the writers above named would denominate large farms. And if the amount of rent is to be the rule of judging, perhaps these would require to be even larger than the foregoing; because a much greater proportion of the produce can, in this case, be allowed to go to rent, than in the other. In every case, where economy in the management of arable land is aimed at, the farm must be of such an extent as to admit of all operations being carried on like clock work, so as that one operation does not interfere with, or interrupt another; and they must be so arranged, if possible, as that no variation of weather can lay the operators idle, or prevent the horses from working, when they would not be endangered by going out of doors: but this kind of arrangement can in no possible circumstances be permitted, unless where the range is considerable,

When the plough indeed is abandoned, and the ground is so rich as to admit of being cultivated entirely by the spade, the same necessity does not exist for having large farms; and they may, without inconvenience, and even with profit, be diminished to a much smaller scale. But, even in this case, there are limits, above or below which, they cannot be permitted to go, without a hurtful influence upon economical arrangements. On the one hand, the price of labour is, in this country, perhaps too high in proportion to the price of grain, to admit of the spade culture being adopted in any circumstances, for the production of corn crops: it must, therefore, be confined to the rearing a few other articles of less general consumption, which never can be accounted of great national moment; chiefly, indeed, to the rearing of esculent plants for the supply of families in towns. Of course, such divisions of land can take place to a considerable extent only in the near vicinity of towns. And they must

be very near, indeed, if the produce can be economically carried to market, or the necessary manures be brought back, without the aid of one horse at least. It follows, that the ground must be of such extent, at least, as to afford constant employment to that one horse and a person to attend him, otherwise a waste must be sustained. This may therefore be stated as the least economical division of cultivated land admissible. Its *maximum*, when cultivated in this manner, cannot reach far: for unless the owner himself works with his own hands, and be almost constantly with his labourers himself, while in the field, a want of economy in this department will soon be experienced, that must quickly prove ruinous to the farmer, if so he can be called. At any rate, this kind of diminutive occupation of land must be very much limited in its *quantum*, so as to be of very small account in a national point of view; and scarcely required to have been here mentioned, except for the purpose of illustration.

The same thing may be said of those small patches which are sometimes occupied by manufacturers, as an accommodation to them in carrying on the particular details of their business respectively. They are to be accounted as mere accidental localities, that are of too small extent to require particular consideration.*

In very light dry soils, that are of a peculiarly rich quality, arable farms may be reduced to a smaller size, with a lesser want of economy, than under any other circumstances: and there may occur situations of this sort, where the advantages that may arise from the minute attention of the occupier, may be such as to counterbalance the inconveniences that arise from other circumstances; or that he may perhaps farm with nearly as great economy, if he keeps no servants, but does the work himself, with the occasional assistance of his wife and family, as if it were let off in larger allotments:

* To this head may be referred the operations of Mr Dempster's settlers, above stated.

but this is the only case I know, in which what would be, by the writers above named, called *small* arable farms, is possibly admissible; and, these situations are so few in this country,* as still less to deserve consideration in a national point of view, than those above enumerated. In all other cases, cultivable farms require to be of a considerable size; more or less as the circumstances of the case require: and till such lands be put into such kind of occupation, the country can never be put into a state of progressive amelioration; or be made to yield *nearly* the *quantum* of human sustenance that it is naturally susceptible of being brought to afford.

The produce of rich grass-lands can as seldom be consumed with economy, without the advance of a large capital, as in almost any other case; so

* In the Netherlands, the soil is in general of this description, and admits of being allotted into smaller farms than any where else that I know of.

that there are few circumstances, except those alluded to above, in which such lands can be properly occupied, in very small patches. Under the dairy management, however, an over-extent may be productive of inconveniences. In the vicinity of towns, lands of this description, like others, admit of being divided into smaller portions, or made larger, than in the country ; where alone, farming, in the proper sense of the word, can be said to exist. And there the *minimum*, even for the dairy, is not of small extent,

§ VII.

Inadequate security of Tenure : Improper Conditions under which that Tenure has been granted, and restrictive Clauses in Leases, Impediments to Agriculture.

THE highest benefits that man derives from civil institutions, are safety to his person, and security of property ; and human industry is always found to be nearly in proportion to the degree in which these privileges are enjoyed, in every country on the globe. In this island great attention has been bestowed upon this subject ; and in most cases the property of individuals is so effectually guarded as to prompt them to vigorous exertions : but some cases of great moment have unfortunately escaped the national attention till the present hour.

Habit has a wonderful influence on the human mind ; so as to be able to bring it to view objects with which it has been

familiarised from its infancy, with indifference, which it would have beheld with horror, had they been for the first time observed only when man had attained the full exercise of his faculties in riper years. It is to this circumstance, alone, we are to attribute that indifference with which men of sound understanding can view the condition of those who are engaged in agricultural employments in this country, without perceiving the remarkable difference between the situations of these men, and that of persons in almost every other profession in this kingdom,—in regard to their security of tenure, and the inducements they have to make vigorous exertions in industry, from the hopes of benefitting themselves and families by these exertions—For the tenure of the land they occupy is so slight, and usually for such a short period of years, and they are so much cramped by the terms on which the lands are granted; that an unprejudiced person, who should attentively consider the whole system of conduct pursued by

landed proprietors, and the ideas that in general prevail in this respect, would believe that agriculture was an employment which it was deemed to be good policy to repress above all others. Yet so far is this from being avowedly the case, that he hears, from every quarter, that agriculture is the most useful and the most honourable of all employments, and deserves to be encouraged above all others.

Such a discordancy between profession and practice might, by a cynic, be construed to imply a degree of insincerity; but when we look back to the state of society in former times in this island, we are enabled to account for it on a more satisfactory principle. Land was originally let off by proprietors to persons who were in the lowest state of depression that slavery produces; so that to allow *them* to acquire property of any sort, was deemed a favour: and no terms however hard could be looked on as severe. Though these ideas, in the most rigid sense of the word, have been greatly mo-

derated, yet it does not seem that they have been entirely obliterated. To this cause I have no difficulty in referring for a solution of the contradictory case above stated. * However this may be, the fact

* I am inclined to think, that the general prejudice which prevails among the vulgar against large farms, and rich farmers, may be referred to the same source. In the state of society to which I allude, there were no classes of men who were thought to be entitled to enjoy the advantages to be derived from wealth, but landed proprietors alone: for lands were originally appropriated by the Sovereign to those who had most distinguished themselves by their military prowess; and military prowess, in those days, being the only criterion of merit, whoever discovered that they possessed that merit in an eminent degree, were immediately invested with lands to exalt them above the vulgar. Witness, the well known origin of the family of Errol, and many others that are on record. Military prowess was, in those days, deemed a virtue of such an exalted nature, that few among the lower classes could aim at it. And landed chieftains, with their immediate descendants, were suffered to enjoy the glory arising from it, without being envied by their inferiors: but when one of the people themselves acquired, by cultivating the soil, a small degree of wealth above his neighbours of the same class, it roused their envy; and they all, of course, concurred with the landlord, in wishing to pull down this upstart, who was supposed to have obtained this wealth, not

is certain, that in no other profession in this country, is a man, who possesses the same amount of capital, and extent of knowledge, and who bestows an equal degree of attention to business, so much dependent upon the will of others, or lives, upon the whole, so poorly, or acquires so little money by equal exertions, continued for the same length of time, as those who are in the profession of Agriculture.

As a proof of this, I wish to refer every reader to the recollection of facts connected with this question, which he himself must know. Is it, I would ask, any thing extraordinary to meet with a

in consequence of a laudable degree of industry, that ought to be encouraged; but to the unfair bargain he had obtained from the owner of the ground, who conceived that every shilling that such a man acquired, was actually filched, as one might say, from himself; and that of course he had a natural right to resume it, if he could. Nor are these ideas totally obliterated, even till the present hour, either among the owners of land, or the herd of the lower classes, who in general borrow ideas from father to son, through many generations, without the smallest attempt to ascertain whether these be well or ill founded.

man in the mercantile business who set out in life without one farthing of capital, and who, merely by diligence and attention to business, has raised himself into respectability; lives in easy and even affluent circumstances; educates a family in a superb style, and at last, when he dies, bequeaths to them a fortune of many thousand pounds? He well knows that this is no uncommon thing: The same thing is by no means uncommon among those who follow the profession of the law; or in the manufacturing line of business; and even in some handicraft employments. But though it is by no means uncommon for a farmer to set out in business with a capital of from five hundred to one thousand pounds,—Where will he find an instance of such a man, either living in a style of as great elegance as a merchant, who began with scarcely one shilling, or bequeathing to his children as much money as would be deemed a very moderate competency, in a

commercial or manufacturing line of business?

If this be so (and that it is so, every person who looks around him must be satisfied) does it not afford the clearest proof that agriculture is forced into an unnatural degree of depression, which it is highly impolitic to continue? Let us now, therefore, enquire into the circumstances that tend to produce this effect, and the easiest means of removing them.

Nor will the enquiry be attended with much difficulty, by one who has read the several agricultural surveys: for there he will find, that a great part of the lands, in every county in England, is occupied by *tenants at will*, who may be thrown out of their possession on receiving six months notice, whenever the landlord pleases. That in cases where leases are granted, these generally run from five to seven, or nine years endurance only; and that a very small proportion, not perhaps, upon the whole, one thousandth part of the lands in England, is held under

leases of nineteen years duration ; which, or twenty one years, may be considered as the *maximum*. And even those precarious leases are full of such restrictions, as tie up the hands of the farmer from ever attempting any essential improvement.

The consequences of such a system of management, on the community at large, are truly deplorable. A tenant at will is not only debarred from all thoughts of making improvements that might benefit the country ;—but he is doomed to a state of humiliating abjectness to the will of another, that degrades the dignity of the human mind : for absolute power, while under the influence even of the best dispositions, tends to corrupt the heart, and lead to abuses that could not have been otherwise thought of. What must it then be, when it cherishes the perverse dispositions of a mind naturally prone to domineer ! The question answers itself : the weight of the rod held over the farmer, in these circumstances, must be diminished by mean submissions, and syc-

phantish adulation. Cunning must take the place of wisdom; and the pleasures of life must be enjoyed by stealth, that they may not excite envy. Wealth, where it can be picked up, must be concealed under the mean garb of poverty; and a spirit of deception and chicane, must pervade the whole mass of the people, under these circumstances. Deplorable, indeed, must be the state of that nation, where the *country people*, who, of all the classes in the state, ought to be naturally the most virtuous and upright, are driven from necessity, to shelter themselves under subterfuges that are so deplorably degrading!

Under a tenure of seven, or of nine years, the case is little bettered. If the tenant shall make an attempt to render the land more productive, it has only a tendency to bring others forward to offer a higher rent, that they may be permitted to reap the fruits of that enlarged crop which has been sown by another; so that the man who ventures to put him-

self under such a predicament, must experience a state of perpetual disquietude, which prudence requires him to avoid; by refraining from all such *injudicious* attempts: for in his situation, assuredly, every expenditure that tends to insure a permanent improvement, must be accounted injudicious.

On a nineteen or twenty one years lease, the case is a little, and but a very little altered. In the former cases, no improvements can be attempted. In the present case, a few may be gone into: but even these must be carried on upon a system that is extremely uneconomical, and eminently productive of national loss. It is well known by every skilful farmer, that land, which is in a poor and exhausted state, in consequence of improper management, cannot be put into a proper productive state, without the expenditure of a considerable sum of money, and the lapse of much time; but that when it is once put into a good and productive state, it may, by a cautious conduct, and judi-

cious mode of cropping only, be continued in that condition for any length of time, without expence. Thus, the tenant under such a tenure is subjected to the necessity of making a great expenditure at first, in order to bring his land into good order, which never would have been necessary, if it had not been for the exhausting mode of cropping that his predecessor has adopted; and which he himself will assuredly adopt towards the end of his lease, that he may get some return for the money he was obliged to expend towards the beginning of it. By these manœuvres, the land is never, even at the best, brought nearly to the highest degree of productiveness of which it is susceptible: but even that moderate degree of fertility which it does thus acquire, it is only allowed to possess for a very short period of the lease; so that the total *quantum* of produce, even when under this management, is wonderfully short of what it easily might be.

Under this mode of management, however, a phenomenon occurs, which is not experienced where the lease is of shorter endurance. The landlord has an opportunity of observing, that his ground is capable of being brought into a degree of productiveness of which he never could have suspected it was susceptible, under the other arrangement. And when he sees it once more brought back to its former state of sterility, he becomes also sensible of a deterioration he would not otherwise have remarked. This circumstance, it is to be feared, in too many cases, prejudices him against this kind of lease, which puts it in the power of the tenant to operate such an obvious deterioration; and he is better pleased with those shorter leases, under which any thing of this kind must be far less obvious. He forgets that that very fertility, which is thus taken away, was added to the land at a former period, by the exertions of the farmer: that it only has outrun the land farmed under short leases,

for a short period, and returns again to the same pitch from which the former never departed. But not satisfied with curtailing the duration of the lease, the landlord finds, that, to prevent the total deterioration of the land during the prevalence of that insecure tenure, it is necessary to bind the tenant to certain prescribed modes of management, which the weakness of our predecessors, at some former period, or the vanity of their successors of the present day, had made them believe were the most perfect that could be devised. The consequence is, that, however deficient these regulations may prove in preventing deterioration, they are found to be sufficiently efficacious, in preventing the introduction of those more perfect modes of culture which the ingenuity of man, when put into proper circumstances, would very quickly devise.

While I thus trace, with a painful minuteness, the rise and progress of a malady that has been productive of miserable consequences to this country in ge-

neral, yet I wish, in a particular manner, to call the attention of gentlemen of *land-ed property* to this subject; because, of all others, it tends the most immediately to affect their own particular income.

It must, in the first place, appear evident to every considerate mind, that the slavish dependance which a tenure of the nature explained above must produce, will necessarily drive away from the profession of agriculture every young man of spirit, ambition, and native energy of mind; who will rather choose to engage in some other employment, in which there is a better prospect of availing himself of his talents and industry. And that this actually does take place, is a deplorable truth, too notorious to be farther insisted on in this place.

A necessary consequence is, that those who remain behind, are of a torpid languid frame of mind, which is rather disposed to sink into indolence, than to spring forward into active exertions; and the situation in which they feel themselves

placed, as naturally tends to augment this torpor, as the light of the sun tends to produce a shadow. Why then should we be surprised, in these circumstances, to observe, that the progress of agriculture is so nearly stationary; and that so many among this class of men, should be contented with blindly following what their fathers have done before them? This surely ought to excite no wonder: but the thing which is truly wonderful, is, that, under these circumstances, there are still *some* men to be found, who can be brought to submit to the hardships they are doomed to suffer in that situation, without abandoning it yet more than has been done; and that there are still some rare individuals to be met with among them, who have made some faint attempts at improvement. This phenomenon can only be accounted for by that instinctive bias which the Creator seems to have impressed on the human mind, in favour of agriculture, rather than any other occupation, seemingly for the pur-

pose of producing food at all times for the subsistence of the human race ; nearly of a similar nature to the instinctive appetite for sex and for food, so universally conferred on animated beings, for the purpose of preserving the individual in health, and preventing the species from being annihilated ; and which instinctive calls are so powerful as not to be subdued by any other means than the extinction of life itself.

It will not be alledged that the agriculture of this country has yet been carried to the highest perfection of which it is susceptible. It will be admitted by every one, that there is as much room for improvements in this branch of business, (perhaps more) as in any that can be named : It will not be denied that there is as much scope for spirited exertions here as in any other walk :—Why then should men of spirit be banished from it ? Money is universally allowed to be absolutely necessary for carrying on its operations properly :—Why then should a constant attempt be

made to keep the occupier of land poor? There is as much scope for the exertions of a sound understanding here as in any other profession, had it room to operate with freedom; and that understanding, if fully exercised, would discover a greater variety of resources for augmenting individual wealth, and national treasures, in this than perhaps in any other employment:—Why then should barriers be every where thrown in its way to prevent the full and free exercise of its powers? This miserable system of regulation and restraint, has been followed long, very long, after its futility has been fully demonstrated:—Why then should it not be abandoned? The welfare of the public demands it; but the interest of landed gentlemen demands it in a still more eminent degree: for, where the public receives a benefit from agricultural improvements in an arithmetical *ratio*, the proprietor's income will be augmented in a *geometrical* proportion nearly.

This assertion will appear paradoxical to those only who have not adverted to this subject; for those who have adverted to it, know well that no rent whatever can be afforded from *cultivated* land, until the produce exceeds the expence of rearing it: and as that expence is in all cases as great in poor land as it is in rich land, usually greater, it follows, that a considerable proportion of the crop must, in all cases, go to payment of the expences. Let us, for example, say that twelve bushels *per* acre is just sufficient for the expence of cultivating, and no more. If so, no rent whatever can be afforded for *cultivated* land that yields only twelve bushels. But suppose the fertility of the land is increased to thirteen bushels; the farmer will be very well pleased to give half a bushel by way of rent. Suppose, again, it is brought to yield twenty bushels; the farmer will be content to pay to the landlord six bushels by way of rent. Say it augmented to twenty-six; the farmer will

be willing to pay ten, or more, to the landlord. Here then the produce, by being only once doubled, from thirteen to twenty-six, the rent has been augmented twenty-fold: and nearly the same *ratio* will hold in every other case. If gentlemen were therefore to consider the case with attention, they would find it much more *their* interest to promote the prosperity of the farmer, and to encourage him to push his improvements still forward without any abatement; because the greater amount the produce can be brought to, the greater will be the proportion of *free* produce; and the greater the amount of that free produce, the greater will be the proportion of it that the proprietor will draw by way of rent.

Thus, in the example above stated, when the amount is thirteen bushels, the free produce is only one thirteenth; and the landlord's rent is one twenty-sixth of the total, or one half of the free produce.

When, on the other hand, the whole amount of the crop is twenty-six bushels, the landlord's rent is *ten* twenty-sixths of the whole produce; or about $\frac{3}{4}$ of the free produce; and although the tenant's profits would, in this last case, when compared with the first, be as 8 to 1; yet the landlord's profits would be augmented as 20 to 1. The profit to the public is as 2 to 1,—to the tenant 8 to 1,—and is 20 to 1 to the proprietor. It thus appears, that, of all the parties concerned, it is most the interest of the *landlord* to promote improvements: for it will be found, that in every case where there are two fields, the produce of which is nearly as above stated, without requiring any immediate outlay for their improvement, the farmer would willingly pay even more rent than is there specified, for the last; though he could scarcely give so much for the first. Yet it cannot be expected that, if the superior produce has been immediately occasioned by his own outlay of

capital, and exertions of industry, he can pay nearly the same *proportion* of it as rent : but after the land has been for some time in a permanent state of fertility to that degree, though it even originally derived that fertility from his own industry, he will be content to pay such a proportion of rent as is here stated, *if no other deductions* are to be taken from his free produce. It is, therefore, greatly the interest of the proprietor, that the profits of his tenant should be thus augmented ; for, in this way, his own rents will be augmented in a much higher degree.

It is upon these principles that I beg leave warmly to recommend to gentlemen of landed property, the plan of a lease devised by the late Lord Kaimes, which seems to me to be perfectly calculated for putting the landlord and the tenant on such a footing with regard to each other, as is liable to no objection that I can see ; for, while it gives entire freedom to the exertions of genius and sound understand-

ing, so it is perfectly well calculated to excite the farmer to make continued exertions to forward his improvements, and, at the same time, insures to the landlord the certainty of receiving an adequate rent for his land, under every possible situation of things.

His Lordship proposed that the lease should extend to an indefinite number of years, consisting of fixed periods, at the end of which a rise of rent should take place; with permission for the tenant, at the period of each of these rises of rent, to give up his farm, if he shall see proper; and granting a similar power to the landlord, upon proper terms, to resume his land if he shall think fit. The particulars of this contract, and the grounds on which they rest, are as under.

Lord Kaimes assumes it as a postulatam, that a landlord and tenant are capable of forming a tolerably just estimate of the value of the land in question, for a short period of years, such as it is customary to

grant leases for in Scotland: say twenty-one years. And having agreed upon these terms, which, for the present, we shall call 100*l.* rent, the tenant expresses a wish to have his lease extended to a longer period. To this the proprietor objects, on this ground, that it is not possible to form a precise estimate of what the value of the ground may be at the end of that period. He has already seen that ground, for the last twenty-one years, has encreased much more in value than any person at the beginning of that period could easily have conceived it would have done; and therefore he cannot think of giving it off just now for a longer period; as a similar rise of value may be expected to take place in future. This reasoning appears to be well founded; and, therefore, to give the landlord a reasonable gratification, he proposes that it should be stipulated, that if the tenant should agree to give a certain rise of rent at the end of that period, suppose 20*l.*, the landlord should consent that

the lease should run on for another period of twenty-one years; unless in the cases to be after mentioned.

It may happen that this 20l., now stipulated to be paid at so distant a period, may be more than the farmer will find he is able to pay; an option shall be given to the tenant to resign his lease, if he should find this to be the case, by giving the landlord legal notice, one year at least, before the expiry of the lease; but if that notice be omitted thus to be given, it shall be understood that the tenant is bound to hold the lease for the second twenty-one years, at the rent specified in the contract. And if the landlord does not give the tenant warning within one month after the time that the tenant ought to have given warning, if he was to remove, it shall be understood, that he too is bound to accept of the stipulated additional rent for the twenty-one years that are to succeed,

It may, however, also happen, that the sum specified in the lease may be a rent considerably below the then present value of the farm: or the proprietor may have very strong reasons for wishing to resume the possession of that land, or to obtain an adequate rent for it. A power, therefore, should be given to him, in either case, to resume the lands, if he should so incline. But as a great part of that present value may be owing to the exertions of the farmer, who has laid out money upon the farm, in the hopes of enjoying it for a second period of twenty-one years, it would be unjust to deprive him of this benefit, without giving him a proper consideration for that improved value. On this account, it should be stipulated, that in case the proprietor at this time resumes the farm, he shall become bound to pay to the tenant TEN years purchase of the additional rent he had agreed to pay; which, in the example above stated, would be 200*l*.

But the land may be worth still more than the 20*l.* of rise mentioned in the lease, and the tenant may be content to pay more, say 10*l.*, rather than remove; and he makes offer accordingly to do so. In that case, the landlord should be bound either to accept that additional offer, or to pay *ten* years purchase of that sum also; and so on, for every other offer the tenant shall make, before he agrees to remove from the farm.

In this way, the landlord is always certain that he can never be precluded from obtaining the FULL value for his land, whatever circumstances may arise. And if the tenant shall prove disagreeable, so that he would wish rather to put another in his place upon the same terms, it never can be any hardship upon the landlord to pay the stipulated sum; because it would be the same thing to him, as if he bought a new estate at *TEN* years purchase, free of taxes: a thing he never can expect to do. It is, indeed, true, that it would be more advantageous for him to allow the

present tenant to continue, than to force him to remove : and therefore this alternative will be always, unless in very extraordinary cases, accepted of, as it ever ought to be. Thus will the tenant's mind be impressed with a conviction that he will continue in his possession : a conviction that ought ever to prevail, because it stimulates to industry in the highest degree.

And as the tenant is thus certain, that, at the very worst, his family must be entitled to draw a reasonable remuneration for the exertions of his industry, he can never find the smallest tendency to slacken his endeavours in any way.

By stipulating in the original lease, in the same manner, that at the end of the second twenty-one years, the lease shall be continued for twenty-one years more ; and so on at the end of the third, and fourth, and any farther numbers of periods of twenty-one years, on agreeing to pay a specified rise of rent ; reserving to each party the same privileges as above described, the lease might be continued

to perpetuity, without either party ever being in danger of having an undue advantage over the other. The tenant will always be certain of having a preference given him over every other person, and will of course go on with unceasing exertions to better his land, which will of necessity tend to augment the income of the proprietor, much more than could have happened under any other system of management.

Such are the outlines of that plan of a lease that his Lordship has proposed. By this plan, the tenant's hands are not tied up by restrictive clauses dictated by ignorance, under the pretext of securing the interest of the landlord. His interest is secured in a much more effectual manner, while the tenant is left at full liberty to avail himself of his knowledge, his skill, and his industry. Instead of ceasing to begin any arduous undertaking, as he ever must do where he has no lease; or of beginning to improve for a few years only, at the commencement of his lease, but

stopping in a short while in the midst of his career, and then running it down to the same exhausted state as it was at its commencement, he continues to push forward without ever stopping; and advances even with an accelerating progress, for an endless period of years. No person, but an experienced farmer, can conceive the difference that would be between the productiveness of the same land, under this management, at the end of a hundred years, and what it would have been, if let even for detached periods of twenty one years each. In unimproved waste lands, the difference would approach to infinity. In lands which were originally very rich, the difference would be less considerable: but, in all cases where cultivation could take place, the difference would be very great.*

* I have seen men of considerable talents, who, from speculative notions of ideal possibilities, have deemed it practicable to devise a lease, by which a man, without having any security of a continued possession in a farm, should be laid under certain restrictions that would prevent him from ever having it in his power to hurt the landlord;

It is worth remarking here, also, that if this arrangement were adopted, a new order of men in civil society would be created, different from any that at present exists. They would be inferior in point of rank to that class of men who are called *gentlemen*, and superior, in point of wealth and energy, not only to the present order of *farmers*, but even to that class of men who are called *Yomen*. The peculiar political advantage attached to this order of society, would be, that while their ex-

and, at the same time, to bring the farm into as high a degree of productiveness, as it ever could attain under the system proposed. But, though we were to admit, (which I am far from doing) that the thing was *physically* possible, I would still maintain, that it is morally *impracticable*; seeing no consideration whatever, except a perfect *conviction* of absolute security, can ever induce the farmer to exert himself continually, and without intermission, to the utmost of his power; and nothing but a lease, legally certain, can impress this conviction on his mind. I consider that kind of metaphysical refinement in reasoning, which confounds *possibilities*, with things *practicable* by man, as one of the greatest curses that can be introduced into society: and I fear, that here, as well as in other instances, its effects have been exceedingly baneful among mankind.

ertions would always insure affluence, that affluence never could become such as to permit them, by imitating the life of the higher orders, to neglect their own proper concerns; for the moment they did so, their exertions in business would become slackened; in consequence of which they could not afford such a rent as others around them would be willing to give, and so they must quit their lease.

Here we are led to perceive the most essential difference, between *thus* granting, what may almost be called a perpetual lease, and every other *long* lease that ever yet has been tried: for in all other long leases, if the rent stipulated at first, shall prove to be at last inadequate, and the holder of the lease be reduced to poverty, by dissipation or otherwise, he may neither be able himself to cultivate the ground properly, nor can another be permitted to do so; and by this means, the proprietor may not only be, for a long period of years, deprived of an adequate value for his land; but that land, also, being locked

up from improvement, may be doomed long to remain in a degree of comparative sterility. Nothing of that kind could here happen. It differs also very much from that sort of tenure which is called yomanry ; in which their small capital, which, if properly applied, would have been just sufficient to give scope for agricultural exertions, by being locked up on the original purchase of the land, deprives the possessor of the only funds he had in his power to apply for improving his land. Instead of active exertions, and chearful affluence through life, he is thus stinted in every exertion ; and is doomed to a perpetual hard struggle against the harassments of poverty. In short, were I either a proprietor or a tenant, I should either let or take land upon these terms, in preference to any other I have ever heard of. *

* Those who are fond of political calculations may have here full scope for their ingenuity, by supposing that two men, of equal spirit, knowledge and capital, set out in the agricultural line,—one of them as a *farmer* on a lease

Several little clauses have been overlooked by his lordship, which it would be necessary to advert to. Some provision ought to be made respecting trees on a lease of this kind,—as it is probable the tenant might find it convenient to plant, which, by the common law of Scotland, he cannot do at present with a view to profit. * Perhaps the wood, if any was on the farm at the time of his entry, ought to be valued, and he should be

of the kind here proposed, and the other as a small proprietor, or *Yoman*. Let the capital be taken any how at random, say 2000*l*. The *Yoman*, we shall say, lays out 1500*l*. of that sum on the purchase of a farm, which, at thirty years purchase, the usual rate at present, would be worth 50*l*. a year; and he has 500*l*. left for stocking and improving it. The other leased a farm, which, at a fair rent, was worth 200*l*. a year. Let him follow out the calculation,—first in regard to the profits that the different occupiers themselves can enjoy, and the rate at which their families may afford to live;—and, second, with regard to the augmentation of Agricultural produce that each of them could afford to the state; and let this be continued for the space of an hundred years. Let him then strike the balance, and see what an amazing difference!

* By the law of Scotland, no tenant has a right to cut any trees upon his farm.

bound to leave at least an equal value upon it, or pay the balance. Whatever timber trees he himself had planted, he should be at liberty to cut at pleasure, for the use of the farm, unless it were such individual trees as the landlord, from situation, or other causes, should think proper to mark for reservation. He should also have permission to sell such trees as he inclined, unless as above reserved, or during the last six years of any of the twenty-one years of the lease. But in case of his removal, the proprietor should either permit him to sell the whole trees that were over the value of the stock at his entry, or take the whole, or such part as he chose to reserve, at an appreciated value. In case of his removal, also, the tenant should be bound not to out-labour the ground during the last six years of the lease, or to crop it improperly, or to carry off any straw or dung; otherwise to pay the damages that should thus accrue to the landlord, at the estimate of two honest men, to be mutually chosen: and to

leave the houses in a habitable condition, and the fences in good repair. There seems to be no other clause necessary in such a lease.

§ VIII.

Want of Capital among Farmers, an Obstruction to the Progress of Agriculture.

THE want of capital among farmers, is experienced to a very great extent, in almost every part of this island; but the effects of that want can only be known, by comparing those districts where the evil has been in part remedied, with those where the malady still prevails to its full extent: a comparison that few individuals have an opportunity of making; and fewer still have adverted to circumstances so attentively, as to be able to trace the causes and consequences of this disease.

Every person knows, that if a man shall attempt to grasp at an extent of trade or

manufactures, beyond the reach of the capital he can command, he must do it with such an enormous disadvantage, as to be involved, in a short time, in certain ruin. The reason of this is, that he has to cope every where with rivals, whose extent of capital gives them such a decided superiority, in regard to purchases and sales, as to knock down all competition. Were all these great capitals withdrawn from those branches of business, this competition would indeed be removed, and the poor trader, or manufacturer, would then be suffered to exist; but his efforts would be feeble, and their effects inconsiderable, in proportion to the weakness of his means. For innumerable obstructions, that must at once give way to the energetic powers of the one, will oppose themselves as irresistible barriers to the feeble exertions of the other.

The case is exactly the same in regard to agriculture. Let two farmers, equally alert, skilful, and industrious, the one of whom has a commanding power of capi-

tal, while the other is stinted in his circumstances, be set down upon two contiguous farms of equal quality in all respects; and observe the result. While the first, in consequence of his being able to avail himself of every favourable circumstance that occurs, can obtain every article he wants at the cheapest rate,—can purchase such manures as may be wanted, to enable him to make, exactly, in the most favourable season for it, at the beginning of his lease, all such operations as he sees necessary for meliorating the soil; and can procure servants and labourers in such abundance, as to carry on his operations without waste of any sort, and at the cheapest rate. The other must have the mortification to see the most favourable opportunities pass, without being able to avail himself of them,—must only purchase manures when he can, not when he would,—must let slip the most favourable opportunities for obtaining a great profit,—must postpone the necessary improvements, because of inability to perform them,—must

content himself only with such a number of servants and labourers as his limited funds can reach, many of whom are those rejected by the rich farmer; and they must besides labour to great disadvantage, because they are thus thrown into uneconomical arrangements. In consequence of this variation of circumstances, while the rich man carries his farm, at once, forward to a great degree of productiveness, which is augmenting from year to year, so as to permit him to pay to the landlord a high rent, while he himself lives in plenty and comfort;—the other pines on in poverty, because of the unproductiveness of his farm, and the unavoidable waste which that occasions; and he can afford, with the utmost difficulty, a very small sum to the landlord by way of rent; which is often squeezed from him, by means that an honest heart would not adopt, could they be fully known to the persons concerned.

I have put the case above, more favourable for the *poor* farmer, than it can ac-

tually be in practice, by supposing that he has equal skill, equal industry, and the same energy of mind, as his rich neighbour : but this is a case that can seldom occur. The mind, struggling against misfortunes, loses its energy ; and it possesses neither the means, nor even the wish, to attain knowledge, that the successful improver enjoys ; whose mind, alert in the vigour of successful exertions, springs forward with alacrity to catch every hint, which promises to add to that capital which he has the satisfaction to find is daily encreasing.

It is easy to see, from what has been just said, that a farmer, with an inadequate stock, must less stand a competition with farmers around him, who have sufficient capitals, than a merchant or manufacturer can do ; because, in consequence of the nature of the transactions of these last, artificial credit can be much easier procured by them, than by the farmer. It, therefore, invariably happens, that wherever circumstances have enabled the

farmers, in general, to acquire an adequate capital, a person attempting to farm among them, without being in similar circumstances, is instantly reduced to beggary; because the rent that his neighbours around him are willing to pay, is far above the standard that he is able to reach.

Such, however, is not the case in those districts where the miserable policy of the landlord has been calculated to deprive their tenants of the means of acquiring that wealth, which alone can produce independance and energy. In such districts, the tenants being all nearly in equal want of means, keep each other in countenance: They live in a deplorable state of inaction:—and pay to their landlords a pitiful pittance in name of rent, which a rich farmer would scarcely account an *arle-penny* * for such land. Every improvement, in such a situation, is preclu-

* I believe this is a provincial word, that may not be generally understood. It means, the earnest money given on engaging a servant; which is always a trifle.

ded, because of want of power to remove obstructions. Roads must be bad, however burthenfome to the tenants; because they neither know how to make them, nor have the power to do it, if they would. The harassments they often suffer on this account from parish officers, in consequence of indictments, often equally merciless and injudicious, take off their attention from the operations on their farms, and render their weak exertions still more feeble. To ward off these evils, recourse must be had to suppleness, chicanery, and cunning. The landlord, if a man of extensive property, is cheated and deceived: — But he is treated with an abject kind of servility by them, that a man of capital would disdain to adopt. No man of that description will submit to conditions which *they* readily agree to; so that there is little danger that a man of sufficient capital, will easily be induced to become their rival in their own districts, so long as the

same mode of management shall be suffered to prevail among them.

I am sorry to observe, that these necessary effects of the operation of wealth, in the hands of farmers, should have been so little adverted to by men of landed property in this island as they hitherto have been, the effects of which have been truly deplorable; and I should consider myself as performing a very meritorious part, if I could flatter myself with the hope of being instrumental in now directing their attention to this object. I own that I see, with much concern, many efforts made by well meaning men, to promote agricultural improvements, which I know must ever prove unavailing, so long as this circumstance shall be disregarded. With a view to produce conviction, I avoid entering into abstruse reasoning of every sort; and only wish that gentlemen will open their eyes, and attend to facts that must every day fall under their observation, if attentive; and

draw their own conclusions from these, without prejudice of any sort. If gentlemen have property in remote districts where tenants are poor, let the native staple of the soil be what it may,—I only desire that they will look at the rent they draw for their lands, and compare it with that which is given for lands of the same extent, whose soil is not intrinsically better than it is in those districts, if they know any such, where the land is farmed by men of substance in general: and I have no hesitation in saying that they will find the difference astonishingly great. I must, however, beg leave to put them on their guard against one circumstance that may induce them to make a fallacious conclusion, which is, that in comparing the soil of the two districts, they will advert to their former state, rather than their present condition: for if the practice of agriculture has been spirited in the one district, for a number of years backward, that soil, which was original-

ly poor, will now have become highly productive ; and of course is capable of affording a rent greatly higher than it ever could, if it had remained all that time under the management of the *poor* farmers.

I shall beg leave to give one example of the truth of what I now say, by stating facts which any one, who will take the trouble of examining the case, will find no difficulty in verifying. Nor can I help regretting that I should, on this occasion, find it necessary to call the attention of English proprietors to Scotland.

It has happened, in consequence of a concurrence of circumstances which may be gathered from the general tenor of this Essay, that the farmers, in some districts in Scotland, have been enabled gradually to acquire, during the last forty years, an adequate stock for the purposes of agriculture ; in consequence of which the land, in these districts, has been meliorated to a degree that no man at that peri-

od, could have believed possible; and the rents have risen with that melioration, to a height that astonishes the proprietors themselves; who, unable to form any conjecture at the rise which will be given them at every renewal of lease, are forced to leave the tenants themselves to name it,—as they thus obtain much more than they could have a face to demand. *

During the currency of the present year 1795, many farms have thus been let in East Lothian, at rents much beyond what any person, a few years ago, could have dreamt of. Whereas, in other districts, where wealthy farmers do not yet abound, landlords find difficulty to let land, of a soil intrinsically as good, at less

* There is one farm, in particular, in Berwickshire, which, less than forty years ago, was rented at thirty pounds, which is now let for three hundred pounds a year. The improvement of this farm has been affected entirely by the exertions of the farmers, who become much more wealthy towards the end, than at the beginning of that period. It is reckoned at present rather low rented than otherwise.

than one fourth part of the rent which is there readily given for it.

In regard to the improvement which time produces on land, when under the management of farmers who have capital, and who have not their hands tied up by injudicious restrictions, I would refer the attentive observer to East Lothian and Berwickshire, where he will find many thousands of acres, which, from ten to forty years ago, carried nothing but heath, and that of a very poor quality, now producing abundant crops of wheat, and every other kind of grain that the climate can ripen, with grafs and green crops of all kinds. It was in consequence of these crops, created by the efforts of industry, that Scotland, which not many years ago scarcely produced any wheat at all, was able last year, not only to supply her own consumption, but even to send considerable supplies to England.

Let these facts be attended to: they speak a language that ought to rouse every landed proprietor in the island from that destructive dream which has deluded so many of them for ages. Let English landlords advert, that while England, which possesses a richer soil, and finer climate than Scotland, was labouring under a scarcity that raised the price of wheat, to a rate unexampled in modern times, Scotland had plenty, and to spare: That while the one part of the kingdom is rapidly progressive, the other is rather retrograde in agricultural exertions; owing chiefly to this circumstance, that from chimerical notions, which have been suck-
ed in with their mothers milk by men of landed property, and injudicious fiscal regulations that have been tolerated in consequence of it, they have contrived to banish from their domains, spirit, energy, and capital, among farmers; and thus to lessen the value of their lands, and to

diminish the produce of the country to a most deplorable degree.

§ IX.

Inclosures, considered as an Obstruction to Agriculture.

I AM aware that public prejudice runs at present so high in favour of inclosures, that what I have to offer under this head, runs a risk of being received with very little favour. Indeed, inclosures are so far from being suspected in any case to be a retardment to agriculture, that men, in general, seem to think, that the inclosing and the improving of ground are synonymous terms; so that, if the lands be only inclosed, scarcely any farther improvement can be wanted.

I do not, however, complain of inclosures universally, as being an obstruction to agriculture. All I mean to insinuate

is, that simply inclosing of land cannot be accounted such an essential branch of improvement as is commonly supposed : and that, under certain circumstances, inclosures may become pernicious.

When land is to be kept under corn crops, inclosures can be of no other use than to prevent the corn while it is growing, or the ground, after the corn is removed from it, from being hurt by trespasses from cattle getting upon it. A ring fence, therefore, around a corn farm, strictly so called, seems to be all the fence that can be wanted for such ; and even that, where it marches with an adjoining farm of the same sort, appears to be unnecessary. But if it should be admitted that it might be in some sort desirable, on account of the neatness and comfort fences seem to afford : it would become merely a matter of calculation to a strict economist, whether the benefit to be derived from them, would repay the expence at which that

benefit must be purchased ; or whether the fence was actually capable of affording that benefit.

In some measure to ascertain this point, let us suppose that a farm, consisting of an hundred acres of good corn land, *uninclosed*, was put under the management of one who was desirous of making the most of it ;—the question is, Should he continue it so, or divide it into small inclosures ?

In its present state, we shall suppose it such as that, on an average, it yields a crop equal to twenty-four bushels of corn *per* acre ; of course the hundred acres will produce two thousand four hundred bushels, or 300 quarters of corn *per annum*.

If this field were inclosed in the usual manner, and divided into thirty inclosures ; (and this is more than the average size of inclosures in many parts of England and Wales :) let us now see what would be the amount of the crop, supposing the quality and condition of the ground to be the same as before. And that the case may be as favourable for

the enclosures as possible, we shall suppose it to be a regular four-sided field, consisting of thirty chains in breadth, and thirty three chains and one third in length; and that it was divided into five divisions the short way, and six the other. The whole fences in this case would measure 430 chains; or 9460 yards.

I find that the most usual kind of fence in England consists of a mound with a ditch on each side. This mound, we shall suppose, is eight feet wide at the base, with a ditch of four feet on each side; which is eight feet more. In plowing ground, it is well known that the plough can seldom come within less than two feet of the side of the ditch, which makes four feet more of ground abstracted from tillage,—in all twelve feet, or four yards of ground lost, for every yard in length. Of course, 9460 yards multiplied by four, gives 37,840 square yards; which is eight acres and a half nearly. Thus is the hundred acres of arable land with which we set

out, reduced to ninety one and a half only; and the produce of course is diminished, to the amount of $25\frac{1}{2}$ quarters *per annum*; which, at the rate of 32 shillings *per quarter*, amounts to 40l. 16s. *per annum*. If the inclosures were of a smaller size, the proportion of ground wasted would be the greater; and if it were of a richer quality, its value would be farther augmented, as is most evident.

Again,—Suppose that, at an average, the expence of inclosing, securing, cleaning, &c. amounts to the rate of one shilling *per running yard*; the sum that must be thus sunk on 9460 yards will be 473l.; which, at the rate of 5 *per cent.* only, amounts to 23l. 13s., *per annum*. This is, supposing the inclosure to be made by the landlord, he would require this much additional rent to make up his loss. But if the tenant shall make the inclosure, it will swallow up so much of the capital that ought to have been laid out on other modes of improvement, as to retard his operations in an amazing degree.

It will be a moderate calculation to suppose, considering his short tenure, that money expended by him on improvements ought to have returned fifteen *per cent.* In this case, the annual loss actually sustained by the farmer, and virtually by the public, will be no less than 70*l.* 19*s.* under this head. These two sums, when added together, make 111*l.* 15*s.* *per annum.*

To this must be added the sums expended in annual repairs of fences; and the loss that the farmer incurs, in consequence of the seeds of weeds being blown from among his fences into his fields; and the destruction done by birds and other vermin, that find shelter in the hedges: which three articles, not to mention the loss from waste labour in plowing, where the inclosures are small, and of an irregular form, will do much more than counterbalance any little benefit he may derive from the loppings from the hedge, and the pickings of grass he obtains from the hedge sides; so that the supposed benefit that is derived from the

mere preventing intrusions from cattle, is purchased at the price of more than at the rate of twenty shillings *per* acre for arable land. Can any damage it might be supposed to sustain from the want of fences, in any case, amount to one fourth part of this sum? And, after all, these are only *nominal* fences over the greatest part of England: for I will venture to say, that there is not one inclosure in a hundred that is a compleat fence all round; and for the most part the mounds are only useless cumberers of the ground, and nurseries of weeds and vermin, which consume and greatly diminish the amount of the produce of the land. Nothing but inattention, arising from the prejudices which mankind imbibe in their youth from the conversation of men whose minds have been biassed in the same manner, could prevent such obvious considerations from being adverted to. How many millions of acres of inclosed land are there in the kingdom, whose whole rent does not amount to the half of twenty shillings *per*

acre? Were I to attempt to make an estimate of the total amount of the encreased products of land, that might have been produced by a judicious outlay, on solid permanent agricultural improvements, of the sums that have been expended on useless inclosures which have been made in this island, within the space of two hundred years past; the amount would be so great as to appear to be incredible. For this reason, I omit it here. My object here, is not so much to estimate the losses we have already sustained by a blind adherence to ancient customs, as now, that the evils arising from these cases are felt, to direct the attention of the public to such circumstances as may tend to ward off similar evils in time to come; and I shall be happy if any thing I shall here say, shall tend to make the subject of inclosures only an object of deliberation. In that case, men will soon discover other facts, which I think it here unnecessary to bring forward, that will furnish additional arguments for hesitating with re-

gard to their utility. As I shall perhaps have occasion to resume this subject, where it will have occasion to be considered under another point of view, in an Essay intitled Considerations on the most oeconomic mode of consuming the produce of a farm,—I shall not prosecute the subject farther in this place, but refer the reader to that Essay for farther satisfaction respecting some doubts which will naturally occur to his mind on this occasion. Here I shall only observe, that whatever annihilates a considerable proportion of the best lands of the kingdom, as inclosures may be justly be said to do ; and abstracts from the purposes of productive melioration, a large proportion of the capital appropriated to agricultural purposes as the erecting of fences undoubtedly does; ought certainly to be productive of benefits that are by no means problematic : for the evils originating in this source are at first sight obvious, and of great magnitude.

§ X.

*Church lands, Lands in Mortmain and Entails,
considered as an Obstruction to the Progress
of Improvements.*

CHURCH lands, and other lands in mortmain, prove a much greater obstruction to the laying off of roads and canals, or making exchanges for the mutual accommodation of parties, than lands equally circumstanced belonging to individuals; inasmuch as they are more unalterable by any person existing: for though all the parties should be sensible of the utility of the proposed change, and willing to agree to it; yet it is doubted if any authority, short of an Act of Parliament, can make a change that is not liable to future challenge. In other cases, too, when a property is small, it frequently happens that one or other of the proprietors who hold it, become willing to sell it in the course

of no long tract of years, so that the inconvenience resulting from these troublesome holdings is gradually done away: but when such small property is in mortmain, it becomes a perfect nuisance to the neighbourhood. It may be compared to one of those incurable wens that some times grow on the human neck, from which there is no hope of deliverance, but by death itself. No leases of a proper kind for promoting industry, can be granted upon such lands, and they must remain small detached unimprovable patches for ever.

It is by no means my wish, to make unnecessary encroachments on the property of the Church, or of any other individual whatever. But where evils that affect, in a strong degree, the community at large, have been the result of a combination of circumstances that were not foreseen at the time when the institutions from which they sprang were adopted; it would argue a great want of understanding, to say, that no attempt should be made to re-

move those evils when they come to be severely felt by the public; although, in every attempt of this sort, as much care as possible should be taken, that those regulations which public conveniency call for, should not tend to hurt the private interest of individuals.

On that principle I would humbly beg leave to suggest, as a matter for consideration of the public,—whether the inconvenience complained of, in regard to this particular, may be removed; and the holders of lands in question be at the same time benefited, merely by a law authorising such lands to be sold under proper regulations: Or, if this were deemed too great an innovation, by permitting all patches of such lands, being disjoined property, if not exceeding in yearly value the sum of l. to be sold by public auction, under due forms; and requiring that the money arising from such sales should be vested in the public funds, the interest of such sums to be applied, in all time coming, to the same purposes

as those to which the rents of these lands, held in mortmain, are at present allocated. Many would be the advantages that would thus result to those having a right to these funds: For it is a truth well understood, that the rents drawn for such lands at present, are, for the most part, very much beneath their real value. And, under pretext of repairs, dilapidations, arrears, and charge of management, prodigious abatements must be made from the gross rents. From facts that have come to my knowledge, I think it would be a moderate estimate to say, that, taking all the mortmain lands of this description in the kingdom, the free income drawn by those who have a right to it, is not above one half of what the gross rent of these lands would be, at the present moment, if they were let on leases of a proper sort; and are less than one fourth part of what it might be brought to in a very short course of years, if under a judicious management. The inference I draw from this fact, is, that were

these lands sold, they would in general bring a much higher price, in proportion to their present rent, than other lands in the vicinity: partly on account of the profit that a person may hope to derive from becoming owner of a small bit of property, and partly on account of the desire that the great landed proprietors beside them would have to acquire these lands. When that money was thus acquired, it would purchase an annuity in the funds, much higher than ever before was drawn from the lands; and the expence of managing that fund would be greatly less than that of landed property. The following statement will shew what the probable encrease of income would be, to the persons having now a right to these funds.

If land sells, on an average, as it does at present, at about thirty years purchase; mortmain lands would sell at forty years purchase, at least, of the gross rent.

Lands yielding 100*l.* *per annum*, of gross rent, at forty years purchase, would bring

4000l. ; the neat free rent of which is at present, on this supposition, 50l., but call it 60l.

This sum, if employed to purchase three *per cents*, at the rate of 60l. *per cent*, would purchase an annuity of 200l.

From which deduct for management, and this would be a very large allowance, $1\frac{1}{2}$ *per cent*, there would remain 197l., which is more than three times the amount of the sum at present drawn.

I am myself convinced that the above calculation will be found to be very near the truth ; but should any one be inclined to think it erroneous in some degree, let him deduct what he shall think proper. It is certain, the balance never can be turned to the opposite side of the account, with the smallest pretensions to truth ; so that, at all events, the income of those who have a right to these lands must be considerably augmented ; and they must of course have an interest to promote, and not to retard the measure proposed.

With regard to other lands in mortmain, appropriated to charitable purposes, which are necessarily put under the management of persons who have no right to apply any part of these funds to their own use; the benefit that would result to the objects intended to be supported by these charities would, by this means, be immense. Parliament has of late had this subject under consideration; but though they have discovered abuses to an astonishing extent, it does not appear that any radical measure for preventing the like abuses in future has been adopted. It is submitted, whether considerable benefits would not result from the ordering these lands to be sold, and the money to be applied as above; with this express injunction from Parliament, that the agent should issue no payments from this fund, for the use of the current year, until the accounts of the expenditure of the money for the former year, in which all the *items* should be *severally* stated, and the vouchers transmitted to a proper per-

son to be appointed to act as auditor of these accounts, were passed by him: especially if it should, at the same time, be enacted, that all the persons in the management of these funds at the time, and their heirs, should be made liable, conjunctly and severally, to make up, out of their own private funds, whatever deficiency could be instructed to have accrued from any misstatement by them, or falsehood in these accounts; if it should be detected any time within forty years of the period when the faulty transaction took place. There seems to be, indeed, no way of curing this evil, but by thus separating the management of the mortmain property from the application of the money arising out of it, to the purposes prescribed by the donator.

One agent might be appointed for the management of the church funds, on whom the respective claimants should be impowered to draw for their respective shares, at stated periods; and another, if it were thought necessary, for the other

mortified funds. These agents to be entitled to retain a specified *per centage* for their trouble; and to find caution to a proper extent for their intromissions.

With regard to entails, I do not find they are much complained of in England. But in Scotland they operate nearly in the same manner to the retardment of improvements, as the church lands in England. The time is not perhaps as yet arrived, when a modification of these can be attempted. And as estates, under this kind of tenure, are usually of considerable extent, they come less in the way as obstructions of other improvements, than the former. But should a time ever come, when very small estates shall be laid under this kind of restraint, I can have no doubt but a measure of the same sort as that recommended above, would be found expedient as to them. Indeed it would be, for very obvious reasons, a much more eligible plan to grant a power by law, to entail to a certain line of heirs the annual rent of this kind of pro-

perty, or the value of so much corn specified, than that of land itself; as it would remove many very heavy obstructions to agriculture, and would provide with equal effect for the preservation of a name, and the continuation of a fixed income, to a certain line of heirs §.

To forward such a beneficial change as this would occasion,—might not a law be

§ I consider entails, and other such ridiculous attempts to perpetuate a name, as alike impious, impotent, and impolitic, in a state of society like that which prevails at present in Europe, and liable to produce political disorders of the most dangerous sort. Wherever ideas of luxury prevail, and those ideas of personal freedom which alone can give energy to human exertions, entails produce a kind of fetters that are incompatible with these notions, and therefore prove exceedingly galling to a vast variety of descriptions of men. They ought not perhaps to be tolerated; but if at all tolerated, should be under such restrictions, as to mitigate, in some measure, the evils that necessarily originate from them. A wise Legislature looks forward to things of this nature; and, in time, guards against the evils of violent convulsions of any sort, by making customs, which have been sanctioned by law, gradually give way to the changes in mens minds and circumstances that are imperceptibly taking place in all stages of civil society.

passed, authorising any owner of entailed property, to sell that property, under the authority of the Court of Session, if in Scotland, or other competent Court, if in England, whenever the proprietor should apply, after having ascertained, under due forms, the present free rent of the estate, whether in money or in kind; the judges being authorised and required to allocate so much of the price, as should be sufficient to purchase an annuity in the funds of the same amount as the free rent of the estate sold; there to remain untransferable, except to the line of heirs prescribed by the entail; the remainder of the price to be at the disposal of the vender of the lands; or, at the will of the Court, to be applied as a fund for younger children. Particular regulations would, in this case, be necessary to be adopted, for securing the interest to the true line of heirs, which it would be easy to devise; but of which it is unnecessary to say more in this place.

§ XI.

*Indefinite claims upon Land, considered as an
Obstruction to Agricultural Improvements.*

To this head are referable tithes, poor's rates, and some others of less consequence.

Tithes.

It appears that the drawing of tithes in kind, is *universally* complained of as a grievance in England; as there is scarcely a single survey of a county, in which it is not mentioned as an evil that ought to be remedied. Nor, indeed, is it a wonder, that this should be complained of as a grievance: for the drawing of tithes in kind, when it is examined with attention, will be found to operate directly, in the strictest sense of the word, as a tax upon industry; and to be at the same time more vexatious in the mode of collecting, than perhaps any tax that has ever been adopted. And if it be

also adverted, that the mode of collecting it is so expensive, as to afford much less to him who receives, than it takes from him who pays, it will not be so much a wonder that it excites universal disgust, as that it has not long before this time been so modified, as to afford relief to the parties interested in it : for it is certainly not beyond the powers of man to devise some expedient, where both parties are sufferers, to give *one* of the parties, at least, relief, if it cannot be extended to both.

There are four different descriptions of persons, who may be affected more or less by the drawing of tithes in kind ; viz. 1st, the farmer ; 2^d, the proprietor ; 3^d, the parson, or the impropiator of the tithe ; and, 4th, the public at large ; each of which I shall beg leave separately to consider.

The farmer. He is more or less affected by it, according to the situation and circumstances of the land he occupies. If it be a corn farm, (and I beg that all the re-

marks here offered may be understood as applying to this description of land,) and if the land be of a rich and fertile quality, so as to require no extraordinary expence in cultivating it, nor any purchase of manure from without ; especially if he has no lease, or only a very short one ; the drawing the tithes in kind can be considered as a matter, to him, of comparatively small moment ; seeing he is precluded by other circumstances from extraordinary exertions of industry. The amount of the tithes, in this case, can be as nearly ascertained as is necessary to enable him to make a calculation sufficiently accurate for his purpose : and the tithe, as to him, can only be considered as a part of his rent ; so that whatever be its amount, he will be able to pay a rent to the landlord, just that much less than he would have done, if that tithe had not been drawn : and he can carry on his operations nearly in the same manner he would have done, if no tithe had been

drawn. It only proves disagreeable to him, on account of some vexatious interferences that may occur in regard to the drawing of the tithes, which he can sometimes convert to his own emolument.

But the case is very different to the farmer who occupies land of an inferior quality, which stands in need of extraneous manures, and expensive disbursements before it can be made to yield abundant crops. His efforts might, in this case, be compared to those of a labourer, who should make considerable exertions during the hours of relaxation throughout the day, in order that he might obtain a bit of something hot for supper; but when he was just preparing to enjoy his hard earned morsel, he had it taken away from him by a neighbour who had stood by idle all day, and now came, by means of a legal authority he had obtained, to seize that which the poor man had so hardly gained by the sweat of his brow, as a reward for some exertions of his predecessor.

fors, when the state of society rendered such a mode of remuneration the easiest of any that could then be devised. Though the poor man is forced to give up his morsel in this case, it is impossible for him to yield it without reluctance ; or ever afterwards to view his neighbour with a favourable eye.—It provokes an invidious parallel to be drawn between the two parties, which estranges them the more from each other. The consequence is, that although, in this particular circumstance, the one gains just as much as the other loses ; yet it tends very little, upon the whole, to the emolument of the receiver : because the loser says within himself, since I cannot enjoy my own morsel myself, I can at least prevent my neighbour from getting it ; for nobody can compel me to earn it but if I please. So down he sits in indolence ; and neither of them enjoy the blessing that might have resulted from industry.

That this is no fanciful case, but an exact representation of what must and actually does happen every day, in regard to tithes, will appear evident from the following statement of facts.—Before a farmer can make any expenditure upon his land, he must have a reasonable certainty of drawing it back; or, if he does not, his own ruin must be the consequence. If he is a spirited man, however, and finds that by the outlay of twenty shillings upon manures, or extra labour, or other means of improvement, he has a reasonable prospect of augmenting his crop to the amount of twenty-two shillings, he may venture to go on: but with less than that he must be a loser. He accordingly lays out his money. His crop is augmented as far as he expected: but, when ready to be brought into the yard, the tithe-gatherer carries off one tenth of his produce; which is nearly to the value of two shillings: and the profits which he had such a good reason to expect, are

taken entirely away : thus he must finally abandon all attempts at improvement on this plan.

Had the farmer been permitted to go on, he could have continued the practice without loss at least ; and the public would have derived a benefit for ever, from such annual outlay, to the amount of *two and twenty shillings* of increased produce : and this twenty shillings of expenditure for purchased manures or labour, would have put in motion an immense mass of industry. — This, again, by being annually returned in the same channel, and augmented, as the moderate profits he derived from this outlay enabled the farmer to extend his efforts wider, till it naturally must have become a source of a prodigious augmentation of the produce, and an infinite addition to the national prosperity. But all these things are entirely stopped, at the very moment it was beginning to be in motion, by *this destructive regulation of police*. Under this point of view, tithe-drawing in kind operates

exactly like the grub which destroys the germ of the sprouting corn; so that instead of a plentiful crop of grain, which the land ought to have produced, it is allowed to remain a waste, covered with thistles and other destructive weeds.

The case of the farmer thus circumstanced, is even harder than that of the poor labourer above stated. If the labourer was not permitted to touch his well earned meal, he was not at least deprived of any part of the property that had once been positively his own, and of which no one had a right to deprive him; but it may very often happen, that the farmer who should venture as above stated, would not only be deprived of the profit he ought to expect, but even of his capital itself, by one who could have had no right to touch that capital, but in consequence of these his public spirited exertions. Though the farmer had a reasonable prospect of drawing twenty-two shillings instead of his twenty of expenditure, yet he can have no certainty of it. No insu-

rer can here be found, as in mercantile concerns, to guard against risk. He must run that risk himself. Instead of twenty-two, he may reap only fifteen shillings. To this, as to the will of heaven, he must submit, in hope that a more abundant return at another time will make up the loss. But even in this afflictive case, the tithe-man comes, and takes from his fifteen shillings one shilling and sixpence, so as to reduce his original twenty shillings to thirteen shillings and sixpence. Is it a wonder that he feels this deduction as a cruel hardship? And if the tithe be demanded with haughty imperiousness, instead of sympathetic lenity, can we be surprised if he feels sore; and deems it a burden that is cruelly oppressive? And can it fail that such an impression will operate most powerfully in checking every future attempt at expenditure, with a view to augment the produce of his farm? No man, who thinks at all, can believe it possible these impressions will not be felt, and that

very disagreeable consequences will result from these feelings.

Other cases might be stated abundantly illustrative of the pernicious tendency of tithes ; but I wish not to enlarge on a subject that is so evident. I shall only beg leave briefly to observe, that experience clearly confirms the truth of these deductions. In England, not to mention commons and wastes, much very fine land is allowed to remain in grass in a very unproductive state, which, with a very moderate degree of industry, and outlay of money upon it, might be made to yield abundant crops of corn : and the reason universally assigned for this disgraceful state of management, (I call it disgraceful, because, were it altered, even the grass land might be easily made twice as productive as it is, by a judicious use of the plough,) is, that the tithe of corn land is so very heavy, as deters the farmer from having recourse to the plough : Whereas in Scotland, where a corn-tithe is never drawn in kind, immense tracts of

country, which thirty years ago were covered with heath, and totally unproductive even of grass itself, are now converted into fertile fields that yield abundant crops of corn and grass; and which, if the tithe-laws had there existed, must in all probability have continued unproductive till the end of time. This is a contrast that is very striking to every one who travels these countries; and it brings forward a practical fact, which ought to outweigh a million of speculative arguments. It will not be alledged that this difference proceeds from the superior energy of the Scottish nation. This is obviously not the case; for it is well known that in mercantile and manufacturing enterprise, where no such checks on industry are experienced, the English clearly take the lead. In every other species of exertion, but in this alone, their superiority is admitted. And even in the line of agriculture itself, it will not perhaps be disputed: for many of the men who have made a conspicuous figure in these

enterprises in Scotland, are actually Englishmen. It can be ascribed to no other cause but the operation of the tithe-laws, and some of the other obstructions to agriculture taken notice of in this Essay, which do not operate on Scotland. The operation of the tithe-laws, then, upon the *actual farmer*, is undeniably pernicious.

Proprietors. But if the tithe laws are hurtful to the farmer, they are perhaps still more so to the proprietor. Whatever checks the industry of the farmer, must in a direct manner diminish the income of the landlord; and as the energy of a farmer, when once excited, is well known to augment in proportion to the advances he has made, whatever checks that energy in the bud, occasions in time a diminution of income to the proprietor, much greater than can easily be conceived.

It was remarked, in a former part of this Essay, that the proportion of rent which can be afforded for arable land, increases with the productiveness of that land, in a much higher degree than in

the *ratio* of the *quantum* of the crop; so that whatever tends to render land permanently more productive than before, if no deduction is made from it, tends, at the same time, to augment the income of the proprietor in a still higher degree.

But as it is obvious, that the tithe operates as a dead bar to the commencing improvements in agriculture upon a soil of no great degree of fertility, so as to prevent the beginning of that motion, from the acceleration of which alone the proprietor can hope to derive considerable encrease of rent; in all cases, his rent is diminished in a much higher *ratio* than one tenth, as it might seem to do by those who take only a slight view of the matter.

Should the proprietor of *poor* lands, seeing the impossibility of the tenants improving them, attempt to render these lands more permanently fertile by the outlay of stock upon it, that he never expected to draw back; but would content himself with a reasonable return of interest of the capital in name of rent, he would

not find the case much altered. He sets out, we shall suppose, with this principle, that if he can secure a permanent rent, equal to five *per cent.* of the money expended upon it, he will be very well satisfied with it. Let us say, then, as before, that twelve bushels was the neat expence of culture, &c. which, on an average of all sorts of corn, was valued at 4s. *per* bushel; and that he had expended 20l. *per* acre, the interest of which, at five *per cent.*, is twenty shillings, or in other words, five bushels. But before he can draw this rent free of tithe, the average produce must be, at least, eighteen bushels, out of which must be taken one bushel and nine tenths; so that instead of five, his rent will be reduced to three *per cent.* nearly; while the tithe-owner will be entitled to draw nearly two *per cent.* for ever, on the capital the improver had thus expended. It is needless to add, under such circumstances it is vain to look for a general spirit of agriculture, either among proprietors or tenants, to both of which descriptions

of men, the operation of the tithe-laws are highly oppressive.

In one other respect does the tithe become singularly pernicious to proprietors of land. The importance of preserving the whole produce of the ground upon the farm where it was reared, for the purpose of making dung, seems to be very generally understood; as I find a clause to that effect is universally inserted in the leases in every county of England, wherever leases are granted at all. What punishment would the proprietors of these lands deem adequate to the crime of selling off the whole produce of the farm every tenth year? Yet great as this crime would be, it would not be adequate, in point of damage, to them, to the right of drawing tithe in kind from their arable lands; because the farmer who *sold* the produce, would at least become possessed of money to replace, in some degree, by means of extraneous manures, the loss he had incurred by the abstraction of the home dung. Those who are intitled to

draw the tithe in kind, are in fact, by this means, vested with a power of enriching their own private property, if they shall so incline, at the expence of every other proprietor around them. In this point of view, therefore, tithes are singularly pernicious to proprietors of land.

Tithe owners, and impropiators of tithes.

Tithes were evidently intended solely for the benefit of the persons of this description ; but it has been seen above, that in the state of society which prevails at present, they have a more direct tendency, in many cases, to prove hurtful to others, than beneficial to them. In a thinly peopled country, where lands are fertile and not fully occupied, and where every man cultivates his own corn, and finds no ready sale for it, this would not be the case. In these circumstances, no expenditure could ever be made on agriculture, but merely for seed and labour; and as the fields would be abandoned by the plough, as soon as they became in a small degree unproductive, and other

richer fields be broke up in their stead, the expence of cultivation would bear a small proportion to the returns; and where corn could not be readily sold at all times, the payment of a part of the produce would perhaps be the easiest way that any kind of assessment could be raised upon the people. This was evidently the state of Europe, when tithes were first established. But the situation of things is now changed, and from that change the evil complained of derives its origin.

Where tithes are to be drawn in kind, the expence of collecting, at different times, as the crops become fit to be carried to the yard, small parcels of corn from a number of individuals at a considerable distance from each other, and from the person who is to receive it, must be very considerable, and must make a defalcation in their amount.

The trouble likewise attending this kind of collecting, must be very great. And to a clergyman of a retired disposition, addicted to literary pursuits, and

studious of quiet, it must prove one of the most unpleasing tasks that can be imposed upon him: so that, of all employments that could be devised, it is in every respect the most unbecoming a clerical character: More especially when it is considered that, from the causes above stated, every person concerned will feel himself disposed to pay it with reluctance, and will throw every obstruction in the way, that he thinks will tend to render it disagreeable and troublesome. To avoid this heavy train of evils, most of the sober minded, well disposed, worthy men among the clergy, wish, at all events, to free themselves from it. If they attempt to draw the tithe themselves, unable to cope with those who are accustomed to transactions where cunning and chicanery are exercised to their utmost stretch, they are imposed upon at all hands, and receive but a very small proportion of what they have a legal title to draw. If they attempt to transfer their right to another, that person must be very well paid for executing

an office which is attended with so much trouble, and so many disagreeable interferences with their neighbours. Few, indeed, will undertake the task, unless it be persons of a turbulent disposition, who are disposed to grasp at all advantages; and who will not perhaps be very scrupulous at imposing on the clergyman as readily as others. In this way, I have reason to believe, that a worthy clergyman, of primitive simplicity of manners, does not, in many cases, realize much more than one half the sum he has a legal claim to exact. To *such* men, this mode of providing a living for them is perhaps among the worst that can be devised.

But if the person having a right to the tithes, be one of a turbulent disposition; one who is eager to grasp at all advantages; one who is regardless of the circumstances of others; one who is little scrupulous about the means he adopts for obtaining an ascendancy over his neighbours; and who, laying aside the decorum becoming a clerical character, engages in a perpe-

tual bustle and wrangling, determined to exact with the utmost rigour every *item* that the law outhorises him to levy; the living, that would be a poor one in the hands of the person of the former description, will be, to him, abundant; and he will live in affluence; while the family of the other is condemned to comparative poverty. In acting thus, however, he loses all influence in his clerical capacity. His practice belies the doctrines he is obliged to preach. He becomes detested and despised. In the performance of religious duties he is deserted: the morals of his parishioners are corrupted, and the finest bands of society are dissolved. He becomes, in short, a disgrace to the venerable body to which he belongs: and the whole order, because of his improprieties of conduct, falls into general disrespect.

Such are the natural effects of the operation of this law on the body of clerical impropiators; and here too it must be considered as equally, perhaps more pernicious on the public than we have felt

it on former occasions. Every law ought to be "a terror to evil doers, and a protection to those that do well." But this law operates in a manner directly the reverse; for it protects only the evil doers, but leaves those who do well to be pillaged at all hands. * Miserable, then, must be the delusion of those who wish blindly to support a system of police, so directly opposite to the principles of common sense, so contrary to the spirit of the religion we profess, and so destructive of sound morals. It is surely a praiseworthy attempt, to endeavour so to mo-

* Farmers, who pay tithe in kind, for the most part consider those who draw the tithe in the same light nearly that brewers or distillers view the officers of excise; and the ingenuity of these two descriptions of persons is almost continually on the stretch to discover some way in which they can be cheated: It is easy to perceive, that a person whose wits have been thus exercised from his infancy, to discover modes of evasion, will at last acquire a considerable degree of dexterity in it, so as often to foil an honest man, who happens to acquire a right to the tithe. This is an evil whose consequences are of wider extent than I choose to develop at present.

dify it, as to protect the innocent, at least, if not to punish the guilty.

With regard to lay impropiators, the complaints against them, when compared with the clergy, are loud from every quarter : nor do I recollect a single instance to the contrary in any of the agricultural surveys. From hence I think it fair to infer, that the clergy in general do not, at the present moment, on an average, draw from the tenants, either by themselves or substitutes, nearly the full amount of what they have a title to exact ; and that, of course, after the allowance to substitutes, and the expence of collecting, are deducted from the payments made by the occupiers of land, the sums that are actually paid into the hands of the clergy will be greatly short of what ought to be paid by the farmers. *

* It has been said by a very ingenious gentleman, Mr Howlet, I think, that the clergy are in general very liberal in regard to the tithes : and that if they were rigidly to exact what they have a title to claim, they would ruin half the farmers in England. I am inclined to believe

The Public. With regard to the effect of drawing tithes in kind upon the *public at large*, enough has been said, in the course of the foregoing remarks, to show that these are pernicious in the extreme; in as much as they put almost an unsurmountable bar to agricultural improvements of every kind;—stop, to an astonishing amount, the circulation of money that would be expended in purchasing extraneous manures, and in prosecuting other means of improvement,—diminish the quantity of corn that would be reared, to an inconceivable amount,—and

that the statement is just; and it brings to light a most alarming truth: viz. that the farmers in England are in a state of the most humiliating dependance, and are obliged, for the sake of procuring even a subsistence for themselves and families, to court favour of the tithe-owners, by every compliance they can exact. The more abatement they have been accustomed to receive, the greater must be their dependance; and the more ruinous to the proprietor; because whenever the tithe-owner chooses to be rigid, the farmer must be ruined, and the landlord must suffer by his calamity. Better were it for all the parties, that the tenant were obliged to pay the full tithe on all occasions, so that it were but fixed in such a way as not to admit of being augmented in proportion to the degree of his industry.

put a check, in the bud, upon those exertions of industry, which would spring up from innumerable sources that would be opened, were this great bar to improvements removed; or at least so altered by judicious modifications, as to secure the interest of the parties for whose behoof the institution was originally made, without being productive of the evil consequences that in its present state result from it.

With this view, I humbly beg leave to propose as a proper, if not a necessary measure, in the present state of society, that the tithes in England and Wales should be converted, so as to make a payment in money be universally received in lieu of the payments in kind that are exigible at present; but under such modifications as to prevent the possibility of those who are entitled to draw the tithes from suffering, by that depreciation in the value of money, which we have seen for a long time past has been going on in a regular progression; and may be expected to continue; or may, perhaps, as at present in

France, be sunk almost to nothing, by some political shock that cannot at present be foreseen.

With these views, might not a law be obtained, authorising the valuation of tithes, in every case where either of the parties interested in it should so incline? This might be done by a summons raised against all the parties concerned, either before the sheriff of the county where the property lay, or before any other judge that should be thought more proper for executing this office; who, after hearing parties, should proceed to make a legal inquest to obtain a clear proof of what had been the amount of the tithes actually paid and drawn, for five, ten, or twenty years past, as should be judged best, out of the several lands in question; specifying distinctly the quantity of each denomination of grain, or other titheable produce. But as it may easily be foreseen, that it would be a matter of great difficulty, in many cases, to get at these facts with precision, might it not be put in the

power of the judge, if the parties could not agree as to that particular, to appoint two or more persons of good character, in the neighbourhood, to gather up the tithes in kind themselves, fairly and honestly, for five years next to come, without favour to any person; the amount to be delivered to the person having a right to receive them, after the quantities had been respectively ascertained, so as to admit of the collectors making up an account of the whole upon oath, to be delivered to the judge; who, from that account so made up, should cause an average to be struck of the quantities of each particular article; which average quantities, after deducting a just proportion for the expence of collecting, and taxes affecting the tithe, should be declared by him to be the legal tithe exigible from the lands in question in all time to come.

But as there is room to suspect, that the money prices of corn, of different denominations, may rise to be much higher in some future period than it is at pre-

sent; instead of now ascertaining the price of these articles, let it be declared, that the quantities of grain resulting from the averages respectively, are payable out of the respective lands, leaving the average prices of such grain to be ascertained each year, as shall be specified below. And as to the other articles in the account, which, as being of less amount, and perhaps much less liable to fluctuation in price, and less easy to be ascertained, it is submitted, whether it would not tend to simplify the business, to have their prices settled at the time, by a jury of honest men to be summoned for that purpose; which being done, all these small *items* being thus valued, should be put into one sum in money, and that sum in money, together with the average quantities of grain specified, should be the whole tithe that could be exacted each year: the time of payment to be specified.

And to prevent all disputes as to the average prices of corn in time to come, let the sheriff of each county be authorised

and required to make an inquest at Candlemas or Lady day, each year, of what had been the actual ready money selling price of corn of the preceding year's crop, from the time the corns were reaped, till the present time, by examining witnesses before a jury to be appointed for that purpose; which prices, after being thus ascertained, should be published, and declared to be those by which the quantity of tithe corn of each particular description contained in any decree of valuation, should be payable for the crop of the preceding year. Thus would the tithe-owner be entitled to receive payment of his tithe, without any extraordinary expence or trouble, or unjust deduction or dispute whatever: The farmer would be allowed to carry on his operations uncramped by those galling restraints which the tithe-laws at present perpetually throw in his way. The proprietor would be at liberty to apply such part of his capital as he might incline, towards promoting agricultural improvements, with a reasonable prospect of be-

ing benefitted by his exertions ; and the public would become possessed of a quantity of surplus produce of land, which it can have no prospect of ever otherwise enjoying, that would be the means of diffusing a perpetual plenty through every corner of the land. *

* The conversion of the tithe has been simplified in the law enacted for that purpose in Scotland ; which though easier in the execution, and perhaps equally just with that above stated, I have not ventured to propose, because the principle upon which it is founded is not quite so obvious as the above. By that law, it is enacted simply, that the rents of the land actually payable by tenants at the time the valuation is made, or the rent that ought to be paid by lands not tenanted, as ascertained by a jury of honest men competent to judge in these cases, being clearly ascertained, that one fifth part of that rent, whether it be payable in money or in kind, shall be declared to be the tithe payable for ever out of the lands in question.

Many considerations induce me to believe, that were this rule adopted in England, the result would ultimately be not very different, in most cases, from that mentioned in the text ; and therefore, as being more simple, and more easily executed, I should, myself, be inclined to prefer : but as I suspect the general opinion would not coincide with mine in this respect, I thought it better to give way to that ; and therefore only mention it in this casual manner.

Among all the persons interested in this particular object, no one of them, it would seem to me, would receive such a benefit from this change, as those established clergy having right to tithes, who are of a quiet inoffensive disposition, and who are ambitious of discharging the sacred functions of their office with decorum of character and purity of heart. I have no doubt, but, in most cases, these men would thus receive an immediate addition to their income, of from thirty to forty *per cent*; and to that would be superadded the satisfaction of living in peace and quiet with all around them, without being under the necessity of guarding against the chicanery of those who had set themselves to prey upon them. To these men, then, the institution proposed cannot fail, I should think, to prove highly acceptable; as it provides for them an effectual shield to guard them against all injustice, which they never could otherwise have obtained.

To the boisterous disturbers of the public tranquillity among the clerical order, and the cunning and avaricious lay-impropriators of tithes, the regulation would prove less acceptable, because it would curb their powers, which they take pleasure in exercising; on which account, although it would doubtless augment their income, yet that augmentation would be in a less proportion than to the others; and therefore it is not impossible but some of this description of persons might be rather inclined to oppose this salutary change. But are the wishes of *such* men to have influence with the public? As soon might the wish of the swindler, to oppose the laws by which he was to be restrained in his wicked courses, be attended to by the Legislators of this land.

The farmer is the only description of persons which could in any respect suffer by the change. At present, it is not doubted but many farmers fall upon shifts for getting a composition for their tithes con-

siderably below their real amount. This they could not hope to enjoy in future; for the agents appointed to draw the tithe in kind for the five years, would no doubt execute their duty with a strict impartiality, so as to prevent any thing of this sort from taking place during that period: To him, therefore, the change might be immediately for the worse. But our view here is not to protect any one in a system of fraud or imposition of any sort, but to do strict justice between man and man; so that he could have no real cause of complaint in this case; and for the trifling loss he might thus, in some cases, sustain, he would derive a power of benefiting himself to a much greater extent, by the more dignified exertions of a manly industry*.

* The farmer may, in this instance, be compared to the smuggling manufacturer, who sometimes gains a little money by fraudulent means, but is seldom seen to become wealthy. His risks are so great, and the attention he is obliged to bestow to guard against these is such, as to call off his attention from the mode of conducting his proper

Upon the whole, I know perhaps no regulation of police that would have a more direct tendency to promote public tranquillity in the state,—to excite a spirit of industry among the great bulk of the people,—or to augment the prosperity of the kingdom, than the abolishment of tithes : so that one would naturally suppose, that, after the public shall have had time to consider of it, there could scarcely be expected that any serious opposition could be made to a measure of such an obvious beneficial tendency. §

business in the best manner ; so that his goods are often of a bad quality, which forces him to adopt unbecoming modes of putting them off ; and this, at the same time that it gives his mind a bias to little arts of chicanery, renders him slovenly in business, that cramps every exertion ; so that he continues in general both poor and abject ; which would not have been the case, had he continued to exert himself fairly in the candid and honest line of procedure.

§ In the text, I have endeavoured to obviate all such objections as might be expected to originate with men who consider the subject with a candid desire to promote the measure, if it can be shown to have no tendency to prove hurtful to honest individuals having interest in it.

Poors Rates.

A more striking example cannot be found of the limited extent of the human

But I am aware of a train of considerations that will influence a variety of classes of men to oppose this proposed improvement ; though these, as originating from secret and sinister views of interest, will not be avowed : but, that they will operate as an irresistible bar, I have no doubt, against the adoption of such a proposal, should it ever be seriously brought forward in Parliament.

I have in the text hinted at the reluctance with which many farmers would give ear to such a proposal ; because they have been in a train of profiting by artifices and chicanery, which they would think they could no longer exercise, were this passed into a law. To these must be added, for the same reason, the farmers of tithes in general through the kingdom. The weight of this kind of influence will be greater than, at first sight, will seem to be obvious : for these men, by giving occasionally hints and innuendoes to their landlords, of the inutility or ineligibility of the measure, will slacken their zeal in the cause, so as to render other objections of great weight.

But the curse of this country is, that a view to Parliamentary interest operates through a thousand unobserved channels, to retard almost every useful improvement, though it dares not be openly avowed. It is this overpowering influence that will swallow up every other consideration in the present case, and render all arguments,

faculties, than what regards the law imposing a poors rate in England. There is not perhaps to be found, in the annals of legislation, another instance in which so

however seemingly irresistible, of no avail. In vain do we now hear innumerable cries of the scanty produce of this island, and the amazing exertions that ought to be made to remove it: This influence, I have no doubt, will make the very obvious means of effecting it, above developed, be entirely disregarded. Tithe-owners of every description find, that the influence this gives them over a very numerous body of voters, is an engine they will not readily wish to part with. And however much a few clergymen, of pure hearts, and primitive simplicity of manners, may wish for the change I have proposed, yet there is not a doubt but the great dignified clergy, and their numerous connections, will all behold such a proposal with jealousy, and reject it with contempt. It is easy to perceive that those descriptions of men, also, who exercise political sway over them, will eye it with the same jealousy. Under these circumstances, what room have we to hope that the voice of *Reason* will prevail? I expect no such thing. But let it be understood, that this is the *real* cause which opposes the measure, whatever shall be the *ostensible* reason brought forward to oppose it, if ever it should be brought under the consideration of the Legislature; which, from the above considerations, I have not the most distant hope of seeing done. Futile attempts

many circumstances concurred to give perfection to an institution, as this. The idea of it was conceived at that period of the British history in which was discovered as great a strength in the reasoning faculties of the legislators of this country as at any other : The object they had in view was worthy of a great and a virtuous people. They aimed at securing for the feeble and helpless part of society, a permanent fund of support, which might render their lives as comfortable to them as human aid can afford. The subject was considered by the legislators with the most anxious attention. Their deliberations were uninfluenced by party zeal, and were calm, moderate and considerate. They placed the subject in every point of view that could occur to them ; and guarded, with a cautious foresight, against every evil that they expected would originate

may be adopted, apparently to encourage agriculture ; but, in reality, to give a little popular fame to individuals, while the only effectual incitements to it that ever could be given, will thus be entirely set aside.

from it. At last they were satisfied they had devised a law which would compel all those unworthy members of society, who were not endowed with the tender feelings of humanity, to contribute in the same *ratio*, in proportion to their means, towards the support of the poor, as others of more generous principles; so that, by making the load press equally on the whole, it could never become oppressive to any part: They considered it as a law, which, while it would enable the industrious person, rendered feeble by age, to repose in peace under the assured certainty of a competent support, would afford no inducement for the licentious and debauched orders of men to hope for a share in it: They considered it as a law, in short, which was to encourage a spirit of industry, and to promote the well-being of society, in so great a variety of ways, as to distinguish England above all others as the wisest of nations, and to render her people the most prosperous and happy of

any in the universe. Any one who looks into the debates of Parliament, and the political writings of the times, will easily be satisfied that the above is a fair representation of the judgment that was formed of the operation of that law about the 43d year of Elizabeth, when it was first enacted. Experience however has proved that all these high expectations were entirely unfounded. It is now discovered that the mode of levying this tax is so far from reaching all denominations of persons, in exact proportion to their means, that it is in its operation more unequal than perhaps any other tax of the same magnitude that can be named : It tends greatly to repress industry, in an immense variety of ways : It promotes dissipation, extravagance and immorality among the lower classes of the people, to an astonishing degree ; and has given rise to a system of speculation, among some of better rank, that has degenerated into a kind of legal robbery ; against the effects of which no

adequate means of defence have yet been discovered. This kind of legal pillage has at length arisen to such an amount, as to have attracted the attention of Parliament; in consequence of whose researches it has been discovered, that the evil has been of late encreasing with such rapid strides, as to threaten, in a short time, to prove the ruin of the country, unless some adequate means shall be discovered for checking its progress. This has at length excited a very general alarm; and gentlemen of property, in many districts, have set themselves seriously to try to moderate this evil. In some instances, they have in so far succeeded as to moderate it for the present. But whether these measures will prove to be a permanent cure, or only temporary palliatives, time will discover.

It would lead me into too wide a field to enter minutely into the consideration of this subject; which is the less necessary, as it has been so well done of late by several very able hands. My object here is on-

ly to shew in what respects it affects the farmer, and those who are connected with landed property and its improvement.

The first point that here demands attention, is the vast proportion of this tax which falls to be borne by land holders: for I believe it will be found, that nearly three fourths of the whole amount of the tax is paid by the landed interest alone.

To give a clear idea of the unequal manner in which this tax affects property of different kinds, it will be necessary to arrange all the property into classes, which for our present purposes may be these three; viz. 1st, landed property, including farmers; 2^d, mercantile and manufacturing property, which may here be considered as one; and, 3^d, moneyed property.

From the mode of levying the tax, which is by a certain *per centage* on rents, it is clear that the value of every shilling worth of property belonging to a landed gentleman, is rated to the utmost extent of the tax; so that if it be at the rate of

fix shillings in the pound, a landed proprietor who draws an income of one thousand pounds, (out of which is also to be taken, in many cases, the land tax,) pays, of poors rates, to the amount of three hundred pounds.

Property employed in merchandize or manufactures is rated to the poor in a much lighter proportion: for I suppose it is no uncommon thing for a man, in either of these branches of business, who draws at the rate of one thousand pounds a-year of clear income, not to pay above one hundred pounds of rent. Supposing he pays the whole of the rates on these premiums, he would only be rated at 30l., precisely one tenth the rate at which the land-owner pays of that fund! Though this be little, still he pays something. But as to the money-lender, let him have an hundred thousand pounds, or ten hundred thousand in the stocks, or at interest upon mortgage, he pays not one single farthing to the poors rates. This is a striking inequality, which loudly calls for re-

drefs. But this is not the worst case that may occur.

The man who is entitled to receive one thousand pounds a-year of land rent, may have contracted debts by mortgage, for the payment of younger brothers or sisters portions; or perhaps by his own extravagance, during the giddy years of youth, to the amount of twelve thousand pounds, the interest of which will amount to 600l. ; so that he has only 300l. of free rents; yet, in consequence of the money-lender being totally exempted of poors rate, this poor man still pays out of his estate 300l. *per annum* to the poor! Thus it appears, that instead of being a burthen, which, by being equally divided among all classes of people according to their means, presses lightly upon the whole, as we must suppose the original framers of the bill intended it should be; and as many persons, who observe not things with accuracy, believe it does, and vaunt of it for this supposed e-

quality, it is the most unequal tax, I believe, that can be named in this island : for while it deprives one class of men sometimes of half the means of their subsistence, it allows other classes of men to wallow in wealth, without paying one single shilling to the poor.

It may appear to us surprising, that a law which has such an obviously partial influence, should have been passed without adverting to this circumstance ; but we have not so much reason to wonder that these consequences should escape the Legislators, as to be surpris'd that a set of sensible men should believe it possible to devise a permanent system of settled coercion, to be limited by rules fixed by them,--or should not have adverted, that as there is a perpetual change in the circumstances of all sublunary things, those very measures, which are salutary at the present moment, may, in the course of time, become highly pernicious. At the time this law was enacted, neither mercantile nor

manufacturing property bore any proportion worth naming to that of landed property ; and as to property in the funds, it did not then exist ; and that which is now called moneyed interest, was but of small account compared to what it now is : so that these might be then disregarded, as of too trivial importance to be worth notice : but things in this respect have since been greatly changed. Nor is this the single case in which particular classes of men have come to be affected in a very severe degree by the poor laws, in consequence of a change of circumstances in this country.

It was not then adverted to that a spirit for manufacture might arise, which would render it proper to erect machinery in many places where nothing of that kind then existed, and to plant numerous bodies of men, for carrying on these manufactures, in places which were before uninhabited : nor were the consequences that the poor laws would have in this case observed. It is now, however, well un-

derstood, that in consequence of the difficulty of obtaining a settlement in any parish, from a just apprehension that these new settlers or their descendents may come upon the parish at some future period, the operations of manufacturers are in many cases very much hampered. It is but a few years since a very spirited manufacturer in the iron branch, found himself so much incommoded by this circumstance, that he thought it necessary to apply to Parliament for redress. In his petition he set forth that he had been at a great expence in erecting works of various sorts on the premises that belonged to him, for carrying on the different branches of his business: that he had also engaged from a great many places in this island, and in foreign parts, many hundreds of persons well skilled in their business, and brought them there at a vast expence; yet, after all, he found his labour frustrated by the proprietors in the parish refusing to allow them to settle in it. And although he had made offer to come

under an obligation to free the parish from all the persons he had so brought from other places ever becoming a burthen upon the parish, yet that this offer was rejected ; the parishioners positively refused to admit these persons to a settlement ; so that he found himself in danger of being subjected to vast loss from that cause : and praying that Parliament would grant him such relief as to their wisdom should seem meet.

To this it was answered, on the part of the landholders, That as, by the poor law, as it at present stands, the whole burthen of supporting the poor in every parish rests on fixed property affording an annual rent, which is thus mortgaged for the support of the poor, to any amount that might at any future period be deemed necessary for them, were it even at the rate of twenty shillings in the pound, it became their duty to prevent, in time, all such measures that might be adopted by others for their own immediate emolument, which should run a risk of deteri-

orating the property of land-holders to such an amount : That the offer made by the petitioner was by no means adequate for their safety ; because, although he should support the immediate emigrants themselves, all the descendants of these emigrants would have a claim for their support, upon the property of the parishioners, even to the hundredth generation and more : That though it should be granted that the petitioner was at present in such circumstances, as to enable him to support the whole of the persons in question out of his own funds, yet as the property of every manufacturer was of a fluctuating nature, so that what seemed to day as stable as the mountains, might to morrow be dissipated entirely, his offer afforded them no adequate security : That were he even to purchase lands for that purpose, these could not be so secured as not to be attachable, in many cases, that could be stated, so as to be carried off, and leave the objects of the present contest upon the parish ; and even if lands to a certain

extent could be so secured, who could pretend, at this moment, to ascertain what might be the amount of the sum that would be wanted, at some future period, for their support? On all these accounts, they contended, that no person ought to have a right so to affect their property without their consent; and Parliament found it was not proper for them to interfere in this case. Thus it is clearly established, that these poor laws occasion such a clashing of interest between the manufacturing and the landed interest, as to prove highly injurious to both. And these mutual interests must continue to prove a most powerful bar to the prosperity of the nation, so long as they shall be permitted to exist.

But though it be easy to state these evils which are already felt, (and many others might be added,) it is by no means so easy a matter to say how they ought to be redressed. Indeed, it would appear to be not a little presumptuous for a private individual, to take upon him to prescribe a remedy for that which has baffled

the wisdom of Parliament itself. I shall not therefore attempt it. All that I shall add, on this subject, is barely to observe, that in many districts the land-owners have already taken this subject under their consideration; and, by their joint efforts, applying remedies to suit the locality of the case, they have succeeded in moderating the evil. But men of landed property have so many other avocations, and are so frequently called from home, that it cannot be expected that they will be able to fix their attention so long on this subject, as to produce any thing like a permanent reform. But were they to grant long leases to able and wealthy tenants, they would thus create a phalanx of steady forces, who would be able to oppose, with a firm and steady effect, every measure that tended to encrease, without a just cause, the amount of the poor rates. For being, from the nature of their employment, always upon the spot; and being immediately and chiefly interested in every augmentation or di-

minution of the poors rates that should take place during the currency of their leases, they would watch over every circumstance that had an effect that way, with a degree of attention that no other person could give ; and would scrutinize every claim, and examine every particular, with such a minute degree of attention, as would prevent, even before they took place, every beginning enormity. This attention being foreseen, would even prevent attempts at many improprieties of conduct in parish officers, which are seldom now attended to till long after they are past ; at which period, an attempt to correct abuses is much more likely to produce additional abuses, than to remedy those that are already established.

This measure would mitigate the evil in country parishes ; and as to towns, they are not so properly within the object of my present enquiry, as to claim a separate consideration. But the land-owners of the country parts of town-parishes, are in a singularly unfortunate situation ; for

they must at all times be loaded with a heavy poor rate, which they cannot mitigate; because, in all questions respecting this subject, they must be outvoted by a number of persons who can be but little affected by the poors rates, whatever they may be. At all events, a law should be enacted, requiring, under the severest penalties, that the account of the distribution of the poors funds in every parish should be printed, and a copy of these accounts be delivered to each house-holder in the parish. In these accounts should be stated every *item* by itself, without being in any case confounded with others. And also it should be enacted, that a committee of three respectable persons in the parish, who have had no concern with the distribution of the poor funds for that year, should be chosen, by a majority of votes of the heads of families at large in the parish, for the purpose of examining these accounts; to whom should be assigned all the vouchers, and who should be empowered to examine persons upon oath

respecting any particular concerning these accounts. They who should be required either to pass the accounts, or to give reasons for refusing to do so, within three weeks at farthest, of the day of their nomination. And let it be at the same time enacted, that in case of any objection being made to the accounts by the auditors aforesaid, the persons who had been in office while the errors complained of took place, shall be, *ipso facto*, prevented from having any share in touching the parish money, until the matter be settled by a legal decision, which should be immediately commenced at the expence of the parish, unless they were exonerated from it by a majority of votes of the heads of families in the parish, at a meeting to be held for that purpose. And if any concealment, wilful error, or false statement in the accounts, should be discovered, within twenty years after the event happened, it should be competent for the parish to bring a summary action at the quarter sessions against the parties concerned,

who should all be liable, conjunctly and severally, to make up the damage sustained from their own private funds, together with such a fine, not exceeding the sum of as the judge should see proper to award. Were such a law as this enacted, and were it competent to bring a summary action, in these cases, before judges in the country, and at a small expence, many good consequences would result from it.

§ XII.

Want of easy means of Communication, considered as a Retardment to the progress of Agriculture.

IN the Essay on roads and canals, this subject will necessarily be pretty fully considered, and the importance of it pointed out. Little more is here necessary, than barely to bring it under view in this place, by referring to what may be afterwards

said, that it may not escape notice here. I shall only farther say, that the importance of this object is such that it cannot be too often brought under review.

§ XIII.

Want of Markets hurtful to Agriculture.

THE advantages of local situation, in respect to the conveniency of markets, is in general known ; but it is by no means sufficiently understood ; and there are innumerable cases in which industry is greatly retarded from this cause, which are scarcely ever adverted to, although, by a little attention and care, the evil might be remedied. To lead the attention into a train of investigating this subject, I shall beg leave to offer a few slight hints with that intention.

To acquire discriminative ideas on this subject, it will be necessary to consider ground, 1st, as being applied to tillage, and 2^d, to pasturage.

In a corn farm, access to market, with its produce, must be obtained, either, 1st, by means of roads ; or, 2^d, canals ; or, 3^d, by sea.

Where all the produce of a farm is to be carried to market by means of roads only, the expence of carriage becomes so great, when at a moderate distance from market, as to reduce the farmer's profit to such a degree, as to put it out of his power to cultivate corn to any considerable extent, unless where the rent is very moderate in proportion to the amount of its produce. Corn can, in these cases, be, in prudence, only viewed as cultivable, merely as a preparation for grass ; but as farmers are frequently inaccurate calculators, it often happens, that in this kind of mixed farm, where the practice of the district has been in favour of tillage in old times, land is, on many occasions, in these circumstances, kept much longer under the plough than it will pay. But as men are now a little more accurate in

matters of this sort than formerly, they begin to diminish the proportion of their corn lands considerably. And this is one, among many other reasons, that have concurred to render the quantity of corn raised in this island so much short of what it used to be in some former periods.

But wherever canals have been made, the carriage of corn to market, and of manures back in return, becomes so much more easy than on roads, that it may be said to bring the markets proportionally nearer to distant places, so as to enable the occupiers of such distant corn grounds to rear much corn with advantage, where it must before have occasioned loss; so that were the tithe taken off, the augmentation of national produce in corn would, from this cause, be greatly augmented. And if ever the time shall come, when small agricultural canals shall become universal; and the modes of facilitating the intercourse on these canals, that will fall to be enumerated under

that head, shall be universally adopted, the produce of this country in grain may be augmented to almost any assignable degree.

With regard to the transporting of agricultural produce by sea, it is liable to so many variations from local circumstances, that no adequate judgement can be formed of it, unless all these circumstances shall be taken into consideration: for it is easy to find two places, which are equally distant from a good market that is alike accessible by sea, and subject to similar hazards; in the one of which places, the market for corn is nearly as good as if the consumers were at the door; and in the other, it is no better than if no such market had an existence. For example:

Lynn, in Norfolk, is nearly at an equal distance from London, as Cardigan in South Wales is from Bristol or Liverpool; both of which markets are equally accessible by sea, and with as little risk as the

navigation from Lynn to London. Yet it so happens, that at Lynn, a farmer can at all times dispose of his corn, in whatever quantities he may choose, let it be one quarter, or one thousand quarters, and carry home the price in his pocket if he pleases, with nearly the same certainty as he could draw money from a banker on whom he had a credit. But at Cardigan, no such thing can be found. He must wait times and seasons, and watch opportunities with care; and, after all, must often take an inadequate price, or submit to such ruinous deductions, as to render it absurd in the farmer to think to rear corn in quantities, or to give a tolerable rent for land to be applied for that purpose, on account of the precariousness of the market.

To explain the cause of this diversity, a very little attention to the circumstances of the two countries will be sufficient. Norfolk has been long a corn county, and merchants have by degrees found it for

their interest to establish themselves at Lynn; to rear ware-houses there, establish correspondences in different places; and, in short, are in a condition to receive, and to pay for any quantity of grain that may be offered to them; and they know how to dispose of it again to advantage in the ordinary course of their business. Ships are sailing from thence every day during the winter season, loaded with corn, for London and many other ports, and it never needs to lie upon their hands almost an hour longer than they incline.

But at Cardigan the case is very different. Little more corn has been in use to be raised there than serves the internal consumption; so that a corn merchant could not find sufficient employment to establish himself there, or to erect the conveniences necessary for his business. No one can buy there but when a chance ship shall come in the way; and then he can purchase only grain of a certain description, and in a limited quantity. The

merchant is only to be found at particular times ; and then he affords not a general, but merely a special demand for a particular sort. The price too will be limited and low : for where there is no general competition of buyers, an adequate price can never be expected. From these, and similar causes, it is, that the distance between London and Lynn, for the corn farmer's purpose may be said to be shortened almost to nothing ; while between Bristol and Cardigan it may, for his use, be said to be little short of infinite. Thus it very often happens, that two things, which are alike physically possible, are exceedingly deversified in their actual practicability.

In the present case, the two places in question may be compared to two places inland, equally distant from a good market, and equally susceptible of an internal communication with it by means of a canal ; but to one of which only a canal has been already made. Though they were a-

like susceptible of this improvement, one of them only has obtained it. Before the other can obtain the same advantages, some persons, who are interested in the business, and capable of compleating the undertaking, must make the canal: for then, and only then, can the farmers and others who are to use it, but who have neither the knowledge nor the means to make it, be benefitted by it. It belongs to the proprietors, in short, to create a market in all such places, if they hope ever to derive an adequate rent for their land: and so long as they shall leave this object unattained, they must content themselves with a very small proportion of that rent they might otherwise easily obtain.

From what has been just said, it will appear, that the possibility of bringing distant corn farms within reach of a market, must depend upon local situation. It must either be within a reasonable distance of a sea port; or an inland canal

must be practicable near it. In every distant situation differently circumstanced, it is impossible that corn can ever be reared with advantage for a distant market. The principal produce of all such farms must necessarily be grafs, which must be consumed by live stock, that can be carried to market along roads that would be altogether impracticable by carriages loaded with corn.

It is by no means necessary for us here to enter into a consideration of the different kinds of live stock proper for particular situations; but it may be necessary to observe here, also, as in the former case, that all places which are *physically* alike, are not *practically* alike benefitted by the market. In one county, for example, proper and well frequented markets or fairs for sales of live stock of all sorts, have been long established; so that animals of every denomination may be there disposed of at an adequate price, for ready money, at almost any season of the year, with-

out difficulty; whereas, on the other, it is only beasts of a certain description that can be there sold, at particular times, and to a few individual persons, *upon credit*; who have it in their power, not only to keep down the prices, but also to become bankrupts, when they please, and defraud the poor sellers of stock to a very great degree. Wherever this practice prevails, it is obvious that the tenant cannot afford to give half the rent for ground of the same quality that he could have done in the other district, where the markets are good. There are many of the distant hilly parts of Britain, whose prosperity is much repressed by want of markets arising from this cause; and it much behoves the owners of land in those districts, to remove an evil which diminishes the income they have a just title to expect from their land, to such an astonishing degree.

I might mention several other circumstances that tend to affect the price of live stock, and to influence the choice of

the kinds to be kept, and the modes of management of these, respecting the peculiarities of market ; but this would lead to too great a length. What has been said may be enough to lead the mind into a train of observation, that may enable any one to form a tolerable judgment of different cases of the sort that may occur.

§ XIV.

Fiscal Regulations that retard Agricultural Improvements.

UNDER this head, as under many others, where the internal prosperity of the country is an object of consideration, the salt laws ever present themselves under a most inauspicious point of view. Here, to avoid repetitions, it becomes necessary to refer to the essay on the economical consumption of the produce of a farm, in this volume, in which it will be shown, that, by the liberal use of salt in feeding

of cattle and sheep, not only many diseases of the latter might be prevented, but also that the same quantity of food might be made to go much farther, by the judicious use of salt in feeding beasts, than it can do without it; so that were the duty on salt removed, and the free use of that condiment universally adopted, it might be said to augment the quantity of food for beasts, I will not say one half, but in a proportion somewhat approaching to it, over the whole island; which is an article of such immense magnitude, as almost to baffle all attempt at calculation.

Under the head *manures*, too, it might be shewn what prodigious benefits might be derived from its application to that use; especially in places that are at a great distance from other manures, and to which they are inaccessible, on account of bad roads, and difficult access, but into which this manure, which can be made to operate powerfully, though in small quantities, might easily be brought; so

that the public would derive a very great benefit from it under this point of view also.

Salt would likewise prove highly beneficial, in many cases, were it brought within reach of the farmer, by enabling him, on many occasions, to procure a market for the produce of his farm, of which he must for ever be deprived without it. This might have been equally well brought under the former head of this chapter as the present ; but I reserved it for this, that all the baneful effects of the salt laws on agriculture might be brought under view at once. Were I to extend this, —to give a view of all the other pernicious effects on the community, it would extend this section to the size of a volume ; and would, besides, be deemed foreign to the subject in hand.

There is scarcely a market for fat cattle in this island, that may not be greatly overstocked by the beasts that can be fattened within reach of it, except London alone ; of course, it may be said that

every farmer who lies beyond the reach of that market, has the value of his property diminished in a certain degree, from the want of proper markets. In some cases, this inconvenience is but little felt ; as there are other markets which, if not equally as good as London, are still considerable : but there are other remote countries, as in Wales, and in the Highlands and northern parts of Scotland, where the possessors of land can *in no way* find a market for cattle that are in a condition for being slaughtered. In these situations, the farmers can never attempt to fatten cattle for the butcher. They must confine themselves to the rearing them only for the grazier. But when it happens that grass, in the feeding districts, fails, or the crops of turnips are destroyed by the fly ; or when the demand for fat cattle from the grazier, is, from any accidental cause, suspended, he finds it impossible to purchase the stock from the breeder that he used to do. This stagnation in the market throws the dif-

tant breeder into the most embarrassing circumstances. He is not only deprived of the money he had a right to expect from the sales of his stock, on which alone the farmer, in a breeding country, can rely for payment of his rent; but he is overloaded with a quantity of live stock, so much disproportioned to the winter food he has provided for them, that many of them actually die for want; and he feels himself reduced, in a few months, from a state of comfortable independence, to the most abject poverty. I paint not here from imagination, but from nature. In my own time, I have seen at least half a dozen of seasons, in each of which many hundreds of families have been reduced to the most abject misery from this cause. If those who shall read this, had, like me, seen, with their own eyes, the misery which the families of these poor persons, without any fault of their own, had been made to suffer, they would not have wondered that I should, with so much anxiety, embrace every op-

portunity that occurs, of endeavouring to obviate evils of the same sort that may be expected in future times to occur; but would heartily have lent their aid to have added force to my feeble exertions. Were the duty on salt removed, all these evils, with a train of others, that would fill a volume fully to enumerate, would be effectually removed. The grazier, whenever a stagnation of market occurred, could cause his cattle be slaughtered, and barrelled up for a future market. The breeder, too, who has always, at the end of summer, a considerable proportion of his beasts that are in good order for the butcher, could in like manner have them slaughtered at home in cases of urgent necessity, and barrelled up for market. The very offals of these slaughtered beasts would prove a resource to the poor people, for the subsistence of their families in such disastrous times; and much of that secret discontent, which is apt to provoke either civil commotions, or to awaken a spirit of emigration, would be en-

tirely obviated. I cannot help, therefore, recommending this subject in the most earnest manner to the serious attention of the Board of Agriculture, through whose means the Sovereign himself, who so warmly interests himself in the welfare of all his subjects, but who cannot possibly have an opportunity of observing scenes of this nature with his own eyes, may come to be made acquainted with them ; who will doubtless, in that case, most gladly lend his concurrence to any plan for affording relief, that has not a tendency to involve any other description of his subjects in similar distress. He will doubtless learn, with some degree of astonishment, if the persons who ought to inform him, shall take the trouble to do it, that while Ireland is supplied with salt and coals from Britain, *duty free*, by which means they are enabled to carry on a very lucrative manufacture to a great amount, in consequence of a very extensive trade in *smuggled* salt to the coasts of Britain, the British subjects themselves

are prohibited from the use of these articles, except when burdened with heavy duties; in consequence of which difference of duties, supposing fresh beef were to be sold at the same price in England as in Ireland, the Irish could afford to sell their barrelled beef in England, full thirty *per cent* cheaper than English beef could there be afforded!!! That this is a fact, I undertake to prove, whenever I shall be called upon for that purpose: And I make that offer in this place, because I am sensible it will appear to be a fact of such an astonishing nature, that every one who reads this, and who has had no opportunity of investigating the subject, will be inclined to believe it utterly impossible. But notwithstanding this apparent impossibility, the fact is certain and incontrovertible.

§ XV.

Want of means of circulating Agricultural Knowledge.

HAVING thus brought under the eye of the Honourable Board of Agriculture, a concise view of those obstructions, of a positive kind, which have for so many ages operated as an irresistible bar to the advancement of agriculture in this island, I shall conclude this chapter with some hints for removing an inconvenience of a negative kind, which, if the former obstructions were first removed, would accelerate the progress of agricultural knowledge in this island to an astonishing degree, and give an energy to practical exertions that is unexampled in any other nation.

The ignorance and the obstinacy of farmers is an inexhaustable theme of declamation, on which many philippics have

been written in our age. With what knowledge a great deal of that invective has been written, a due attention to what has occurred in the foregoing sections of this Essay will sufficiently show. There can be no doubt, that while the obstructions above enumerated shall continue to operate, it would be nearly with equal justice, that we should revile a man for his indolence and aversion to work, while he was bound hand and foot so as to render him incapable of moving, as to complain of the determined obstinacy of farmers, for not doing those things that were equally beyond their power. Let these obstructions be once removed, and they will be in a condition to bestir themselves; and there can be no doubt but they will be then seen to do it with effect.

From the nature of the business he follows, a farmer must be necessarily confined pretty much to one spot. This limits the sphere of his own practical observations to a narrow extent. He has neither money to spend in buying many

books, nor much inclination to put reliance on directions that are published in books, many of which he knows are written by men who have had as little knowledge of the *practice* of agriculture, as he has of the *theories* with which they bewilder him. Finding himself unable to discriminate between the good and the bad; and being sometimes imposed upon by a specious title page, to look into performances that promise much, but which he finds upon trial to be worth nothing, if not pernicious, he generally concludes that all writings on that subject ought to be despised. In this way, his knowledge of the practical parts of agriculture necessarily remains limited, as to him and his heirs, for ages entire, to the narrow sphere of his own observation nearly. It is in this way we are to account for a phenomenon that has been long observed by intelligent men, and which is made very apparent in reading the surveys of the different counties laid before the Board of Agriculture; viz. that a particular and

beneficial practice in agriculture may have been followed for ages in one district, while it has never so much as been heard of during all that time in many other parts of the country, where it might be adopted to the great advantage of the parties concerned, and the community at large. * To disseminate the knowledge of these practices universally among the class of farmers in every district of Britain, through a channel that was not liable to the suspicion of misleading either through ignorance or fraud, and to bring that information to their hand, without trouble

* I cannot produce a more striking proof of this, than occurs in respect to the irrigation of land; a practice that has been found in the highest degree beneficial in Wiltshire, and several other counties of Britain, where it has been practised as an improvement of the very first consequence for ages. Yet, through the greater part of the kingdom, it was never heard of till of late; and in many very extensive districts, the farmers in general know nothing about it, even at this time. Though there is not a doubt, that were this practice introduced as generally as it might be in every district, the total produce of the island might be augmented by that means alone to the value of many hundred thousand pounds *per annum*.

or much exertion on their part, and at such a moderate price as to be within the reach of every one, is as yet a *desideratum*; and it would probably have continued to be one till the end of time, had it not been for the institution of the Board of Agriculture, which is in its own nature so perfectly adapted to the purpose, and it seems to be so congenial to the wishes of that Board, in as far as they have been hitherto indicated by their proceedings, that it is to be hoped that a plan for obviating this inconvenience will be adopted, as soon as other preliminary arrangements can admit of it.

What is wanted is an agricultural journal, to be compiled under the direction of a judicious man, who is well acquainted with the practice of agriculture himself; who has had a liberal education and opportunities of obtaining a more enlarged knowledge of the practice in different places, than can fall to the share of most farmers to acquire; and who is in such circumstances as to enable him to

examine with accuracy any particular about which he may be in doubt, and to state it with precision ; and who is, at the same time, so anxious to guard against leading the unwary into errors, as to be extremely cautious how he holds out hopes to the lower classes of practitioners that he was not certain could never prove delusive. Under the sanction of the Board of Agriculture, such a man could have access to every fact that it was of general importance to be known ; and under that authority, such a body of *practical* knowledge could be universally diffused among all the farmers in every part of this island, as never has been yet known in any other country in the world. This would excite an universal spirit of exertion, and that would give rise to new discoveries every day. And discoveries, if published as they were successively made in the same journal, under the controul of the whole practical farmers in the island, would, in the course of a few years, carry this art to a height of

perfection that has been hitherto deemed unattainable.

To render this work universally useful, it should be published, not gratis, for that would make it despised; but at a price below what it could be afforded by a bookseller, or other person who must look for profit from their undertaking. This profit the Board has no occasion to look for, and ought to sacrifice, together perhaps with a small sum annually, for moderating the price still farther; because it should be adapted to the circumstances, not of the most wealthy farmers, many of whom stand in little need of instruction; but of the inferior orders, who have had fewer opportunities of having their minds enlarged.

In order to render this publication accessible to those, also, who have the most occasion for it, by living in remote districts where literary information is rare, this journal ought to be permitted to be sent by post, free, to every part of Britain; and, doubtless, for such a national benefit,

where private emolument is out of the question, Parliament would have no difficulty in granting this exemption under due precautions for preventing the abuse of it. To render this exemption nothing burthensome to the mail, two devices might be adopted : The *first* would be, to have this journal published at short intervals, by which the weight of the same number of copies would be less, and more equally divided, than if the same matter were put up in thicker numbers. The *second* would be, to forward it from London in such a way, as that it might reach the place of its destination in every part of the island upon the same day : Of course, the parcels of the same number would not all go by the mail in one day, but on different days, according to the distance of the places from the capital ; and the best day that could be fixed on for the delivery, would be Sunday, or on the market day in a town ; because, in distant parts, the whole packet for one parish, if sent to the parish church, or the market town, could easily

be conveyed from thence. And, in other places, it would, in general, be the most convenient day for receiving it. Under these two regulations, no inconvenience could result to the mail. The revenue could suffer no loss; because it is very plain the work could never be published so as to go by post as letters. It would even prove a considerable augmentation to the revenue, by the additional duty on the paper it would consume; so that no objection from the Revenue Board could lie against the measure.

If a man could be found, who was capable of keeping himself perfectly independent of all parties; and who should invariably direct the attention of his readers steadily towards objects of agricultural and georgical research alone, regardless alike of those objects which for a time seem to affect the interest of the minister or his opponents, it would prove one of the most valuable performances that has appeared in any language; and would form an interesting epoch in the

history of Great Britain. But is it in Britain that such a man is to be found? Perhaps in the present age it may be deemed impossible.

It may, indeed, perhaps be difficult to find such a man; but I fear it will be still more difficult to find a body of men of high rank in this island, who will take an active hand in promoting any public undertaking, that does not seem to be calculated, in one way or another, to be converted into a political engine capable of forwarding the views of a party, or the private aims of individuals. In the present times, it would perhaps even be a matter of some difficulty, to find a very large body of readers, who would be so much interested in any publication that did not enter into political discussions, or scandalous anecdote, who would peruse it with a continued attention for such a length of time, as would be required fully to effect the purposes here proposed. From these considerations, I fear the plan will have too much of an Utopian perfection ever to be

carried into practice ; or, if ever it shall be attempted, it will require a greater degree of steadiness in the conductor of that work, than can reasonably be expected in man,—to suppose that, assailed as he would be by so many tempting lures on every hand, he should be able to persevere, without wavering, in the right path for any considerable length of time. But though the utmost degree of perfection can never be attained in this life, men ought not to be deterred from proceeding as far in the right path as they can. It is with this view, that the foregoing hints have been thrown out to the public on these numerous important topics which have come under review in the present Essay.

THE END OF ESSAY FIRST.

ESSAY SECOND.

ON

WASTE LANDS,

AND THE

MEANS OF THEIR IMPROVEMENT.

2

*Labor omnia vincit : sed sine lucro industria
languit.* ANONYM.

ESSAY SECOND.

ON WASTE LANDS, AND THE MEANS OF THEIR IMPROVEMENT.

LANDS, whether private property, or commons, lying in a neglected state, may be denominated wastes. These lands may be improved either by being brought into cultivated fields, or by being planted with trees, which will require to be separately considered.

PART FIRST.

*On the Improvement of Waste Lands by means
of Culture.*

AS I have had occasion to consider the influence of the right of commonage, in the foregoing Essay, my views shall here be confined to the consideration of the practical means of improving waste lands,

supposing the person who undertakes this task, to be at liberty to adopt the measures that shall appear to him to be most expedient for that purpose.

§ I.

Preliminary Observations on the circumstances that require to be adverted to, before the Cultivation of Waste Lands should be attempted.

THERE are very few soils that may not be converted into corn fields by human exertions judiciously applied ; but there are many cases in which that melioration cannot be effected, but at a greater expence than will afford a reasonable indemnification to the improver : It therefore behoves every one, who has such improvements in contemplation, cautiously to consider all the circumstances that can affect his operations ; to weigh deliberately the influence that each may separately have in his particular situation, and, after

having taken a complex view of the whole, to adopt those measures only that afford a reasonable prospect of indemnification for the outlay of stock and labour upon the undertaking. The following are among the principal circumstances which ought to be adverted to in a case of this sort; as any one of them, being in favour of the undertaking, or in opposition to it, may have the affect of turning the balance either to the profit or loss of the account.

1st, The nature of the soil, and subsoil of the subject in question.

2^d, The physical obstructions that stand in the way of cultivating that soil, as arising from rocks or stones, brushwood, trees, &c.; hurtful moisture, whether arising from springs or surface water, whether temporary floodings, or permanent soaking; inequalities of surface, whether occasioned by pits dug out, or heaps raised up, or from the natural swell of mountains or great acclivities, that may retard the operations of agriculture.

3*d*, The climature, whether respecting the general quantity of rain that falls, or the particular seasons of the year at which these rains usually happen ; the degree of heat or cold that there prevails, and the particular modifications it admits of from the peculiarity of circumstances ; the quantity of snow that falls, and the time it usually lies ; the winds that chiefly prevail, and the shelter or exposure that the form of the ground offers in that respect.

4*th*, The vicinity or the distance of the place from towns or markets of any kind ; the size of these towns, and the extent and universality of the markets within reach.

5*th*, The kinds of extraneous manures that can be purchased ; the price at which they can be obtained ; the distance from whence they must be brought ; the times at which they can be got, and the quantities that can be procured at once, or in a certain order of succession.

6th, The nature of the roads or other means of communication, to or from the premises; whether these be steep and hilly, or level and plain; whether they be hard and rough, smooth and firm, or deep and miry; whether they be equally passable at all times of the year, or during particular seasons only; or whether, from the state of the country, they are in a train of amelioration or the reverse.

7th, What conveniencies the premises afford for erecting houses, rearing fences, making drains, and other necessary operations.

8th, How the premises stand affected respecting water; whether for the purpose of flooding the lands at pleasure, or of fencing it off for the purposes of amelioration; whether for family uses, or for the conveniency of live stock in inclosures at all seasons.

9th, The state of the premises respecting fuel, the kind and quantity that can be

commanded, and the price at which it can be afforded.

10th, The state of the country respecting servants and labourers; the wages and mode of entertainment that prevails in the district respecting servants; the way in which they have been accustomed to work; the practices that are there established, in regard to working hours, management of teams, carriages and home labour of every sort; the kinds of work that the custom of the place has rendered too servile to be performed by particular discriptions of servants; the manner in which assistance can be procured in these respects; whether extra-labourers can be obtained for hire, in sufficient numbers, when a particular push happens; or whether they must be engaged afar off, and kept in employment when not wanted, to serve at that particular push; whether it is the custom to pay labourers wholly in cash, or partly in victuals and drink, and in what proportions, denominations

and quantities: whether work can be got done by the piece, or by time only, with many other items respecting this head.

11th, The state of the country respecting mechanic arts; the facility, or the reverse, with which labouring utensils of all sorts of a good construction can be made or repaired, and the stile of expence that custom has established in regard to this department of rural economy.

12th, The nature of the tenure by which the lands are held: if the operations are to be performed by the tenant; the rent that is exacted from him, and the nature and amount of other claims that he must expose himself to in consequence of his occupancy or operations, whether this be under the name of land-tax, tithes, poors rate, road-money, repairs of houses or fences; the length of his lease, the probability or the reverse of his being made to incur expence by law-suits, in consequence of arbitrary exertions;

and every other circumstance that may render his tenure more precarious, or his property less secure : for, in most undertakings of this sort, a man may be said to “ cast his bread upon the waters, which “ can only return to him after *many days* ;” and he ought well to consider, before he throws it out, what is the risk of its being snatched from him or his family, before it can be returned again.

A man, who attentively considers all these circumstances, may be able to form a tolerable idea of the *kind* of improvement the subject admits of, and the *degree* of amelioration of which it is susceptible, on the supposition that he himself is capable of conducting the requisite operations in a proper and judicious manner : but any person who sets about agricultural improvements, without having previously weighed all these particulars, may be compared to that man who should embark on board a vessel in an unknown sea without a compass, who may land he

does not know where ; and ten to one if he is not wrecked upon some unlooked for shore.

To give particular directions how to proceed under every variation of circumstances above enumerated, would greatly exceed the bounds to which I must here confine myself : Nor does this seem to be absolutely necessary, seeing it would be the wildest scheme imaginable, for any man, who was totally unacquainted with the practice of agriculture, to engage in an extensive undertaking of this sort, were he even furnished with the most minute directions that could be given ; because he would find it impossible to apply these directions properly in all cases. To such a man they would be useless ; and to a man who is already acquainted with the practice of agriculture, many of them would be quite unnecessary. All that can be done, then, in this case, with any seeming degree of propriety, is to mark the great outlines of practice that may safely be

purfued in a few cafes that are widely difcriminated from each other, leaving the judicious cultivator at liberty to exercife his judgement, in properly varying his practice, fo as to make it apply to the intermediate cafes according to every gradation of circumftances.

The neighbourhood of great towns peculiarly favourable for the improvement of Wafhes.

—The greateft enterprizes in regard to the improvement of wafte lands, may be made with fuccefs in the near neighbourhood of a large town, which, from its fituation, is cut off from having ready accefs to a fertile foil on any fide. In fuch a fituation, a price fo very tempting is held forth to the perfon who fhall bring to market frefh efculent productions for the table, and fuculent food for cows, horfes, and other animals, and for other weighty productions that cannot admit of being brought from a diftance, but at a great expence, as affords a ftrong allurements to

men of property to risk their capitals in agricultural improvements, in the hope of benefitting their families by a permanent income out of the land which they thus reclaim from barrenness, at the expence of a fair purchase price. In these arduous enterprises, which can only be undertaken to their full extent, where personal property is secured from the danger of casual attacks from any quarter which might render the permanency of that income doubtful, the very possibility of succeeding often depends, on the one hand, upon the great quantity of manure that can be obtained from the city, in proportion to the extent of ground that can be cultivated near it; and, on the other hand, upon the price that can be obtained, at hand, for articles, such as stone, sand, clay, stubs of tree-roots, &c. which could not have been otherwise cleared off the ground with the smallest prospect of reimbursement. In situations such as that I here describe, the utmost possible proportional melioration

of waste ground cannot be estimated with accuracy. There are few, if any soils so bad, as that, in these circumstances, under a skilful management, they may not be converted into rich fields permanently productive. I have certainly seen many fields thus situated, which, in the course of a few years, have been put into a train of yielding an annual produce of perhaps *one thousand* times the amount of what they ever could have done if left in a state of nature.

The importance of this fact, in regard to the welfare of a state, deserves to be carefully adverted to. It brings forward, under a striking point of view, at the same time the *possibility* of augmenting the subsistence of man to an astonishing degree, and the facility with which this kind of *creation*, if the phrase be allowed, might forever be prevented from taking place. For if all the waste grounds in the neighbourhood of the town had been a *common*, no improvement could have ever taken place upon it so long as that common remain-

ed. And if the persons having interest in that common are numerous, it will be impossible ever to bring them to consent to an amicable division of it : and if it be attempted to be divided by the authority of Parliament, the expences that must be incurred before it can thus be effected, will be very great; in consequence of which that improvement, which without this obstruction could have been made with a prospect of a reasonable profit, cannot now be attempted without a certainty of loss. For this reason, the enterprize must be abandoned ; and the land must be doomed to remain for ever an unprofitable waste.

No expence should be incurred, but that which tends to remove physical obstructions only.—The same reasoning will apply to every other case where the improvement of waste land, under any circumstances, is in contemplation. In the neighbourhood of large towns alone, the expence incurred in improving *the most barren wastes* can be re-

paid. As you recede from these great marts, it is necessary that the soils be of a greater degree of fertility, before the expence of cultivating them can be repaid; and still the farther you recede, and the more unfavourable the markets, and the less abundance of extraneous manure that can be obtained,—the richer and richer must the natural soil be, before the expence of cultivating it can be repaid; and consequently, the smaller will be the proportion of waste land that can be brought into cultivation. In all cases, however, whatever extraneous expence comes to be added to the sum that is required to remove the absolute *physical* obstructions to the cultivation of the soil, must of necessity make a proportional narrowing of the possible sphere of improvement. This is a proposition as plain as any in Euclid; and an unavoidable corollary from it, is, that every shilling that is laid out by individuals, in their private capacity, for procuring Acts of Parliament for the division of commons, and for removing o-

ther *political* obstructions to the progress of agricultural improvement, is a most impolitic diminution of the actual productions of the country,—a defalcation from the subsistence of the people,—a cause of enhancing the price of provisions beyond the rate that nature had intended,—and of thus retarding the manufacturers, the trade, the national prosperity of the country;—and, by the abstracting of them, producing a diminution of the population and the revenues of the State.

No share of the profit arising from the improvement of Wastes should be abstracted from the undertaker.—The same reasoning will apply to every other circumstance, under whatever form it shall be brought forward, that tends to narrow the security, or to diminish the profits of the operator on waste lands. It is evident, that no man can cultivate waste lands, unless where he can have a full return for the outlay of his stock and labour. In every situation, there is one certain degree of fertility of soil, which

will barely admit of a return for the money that must be expended in removing the mere physical obstructions to improvement, and no more. In all such situations, if the undertaker has a permanent security that he shall be allowed to reap the *whole* profit that he can derive from the sale of its *total* produce, he may proceed in that improvement; but if he knows that he will not be allowed to dispose of that produce, he *cannot* proceed: and those soils which, in the first instance, might by his industry have been converted into productive fields, must, in the other case, be doomed to remain, till circumstances alter, in the state of barren wastes.

On this principle the pernicious tendency of that ill judged tax upon industry called *tithe*, comes once more in our way as an evil that is very aparent; a tax that, without producing any good in these circumstances to those who claim a right to demand it, has operated, perhaps more than all the other taxes in this country,

to retard the progress of agriculture, and to diminish the national prosperity : Yet, wonderful to tell ! There are men in this enlightened land who are not ashamed to say, that they do not conceive the drawing the tithe in kind can be accounted the smallest obstruction to agriculture !!!

It was necessary that I should thus state, with as much clearness as the brevity to which I confine myself will permit, the circumstances that have operated, and must for ever operate, in a most powerful manner, so long as they shall be permitted to exist, towards the preventing the improvement of waste lands. For, without taking these circumstances into the account, to prescribe rules for overcoming the mere *physical* obstructions to the improvement of waste lands, and to talk as if that were all that was necessary for establishing a general spirit of vigorous enterprise in the cultivation of them, would be a species of *charlatanerie* that it would be as unbecoming in the Board of Agriculture to countenance, as it would

be unworthy of my own private character to adopt. That Britain is susceptible of very great improvement, there can be no doubt: that it is *physically* capable of being brought to afford, to speak in the most moderate terms, *ten* times at least the amount of its present produce, admits of the clearest demonstration. But that it *will* advance in productiveness, while the present system in respect to the private management of agricultural concerns, and of legislation affecting rural affairs, prevails, seems to me to have not the smallest degree of probability. On the contrary, it will be discovered, at last, that the diminution of agricultural produce, which has been so obviously perceptible for some time past, will become still more and more apparent, in proportion as men shall withdraw their capitals and skill from the practice of agriculture, and apply them to some other profession that will render them more independent members of society, and afford them more adequate returns for their industrious exertions.

Agricultural enterprizes in England less profitable than those in trade or manufactures.—

In the foregoing Essay, I had occasion to take notice of the circumstances that chiefly obstruct the agricultural enterprizes in *England*, by means of which the industry of that active people is forced into another channel: Some of which not affecting *Scotland*, it there becomes, in some cases, a matter of calculation, to ascertain whether it will be most advisable for an individual to apply his capital and skill in agriculture, or in trade or manufactures.

*Difference between England and Scotland, in regard to agricultural improvements.—*Upon these principles, there are many instances of men there vesting a *small* part of their capital in the purchase of waste lands, and appropriating the remainder of that capital towards the melioration of the subject, with a view to future profit, as they would do in any other employ-

ment ; and, as might have been expected, it has been done with greater or less success according to circumstances. In many cases where this has been attempted, the undertaking has been both arduous and hazardous. The original purchase-price of the land has, in some cases, not amounted to one hundredth part of the neat expence incurred, before the subject could be let for a steady permanent income. A great part of the expence incurred, in many instances I have known of this kind, has been occasioned not so much by the melioration of the soil itself, as by steps that were merely preparatory to admit of those operations which were necessary for its actual melioration. The clearing the ground of stones, in particular, is a very heavy charge in most cases ; and, in some cases, especially where large hard bullets of whin-stone or granite abound, which must be blasted by gunpowder, before they can be brought to a manageable size, the unavoidable expence is exceeding great : and as those stones are

often concealed beneath the surface, the amount of that expence admits of no previous accurate calculation. But as these stones must all be cleared away, at whatever expence it may be, to the full depth of a plough furrow at least, those who engage in undertakings of this sort, usually find it most economical, upon the whole, to trench the ground to the requisite depth, by which means alone the stones can be accurately discovered at once, so as to avoid a series of endless future operations. Under this mode of improvement, I have seen fields cleared where the stones were in such quantities, as that, finding no other mode of consuming them, but by putting them into walls reared as fences round the fields, there was a necessity for making the walls from six to nine feet in thickness, on purpose to consume the whole of the stones, although the fields were divided into inclosures not exceeding two acres in each. In cases of this sort, the undertaker never looks for a return of the *capital* sunk on the premises

by the *annual* produce ; but is perfectly satisfied with this success, if he can let the lands at a permanent rent, which *shall* be equal to five *per cent.* of the whole money thus expended ; being either satisfied with the legal interest of his money, if his circumstances admit of it ; or, if he requires his capital, he has only to sell the subject, when he is certain of receiving from 25 to 30 years purchase of the gross rent,—which improved capital he may either apply to another undertaking of the same kind of still greater extent than the former, or to any other purpose he may incline.

The cultivation of Wastes a sort of business in Scotland.—In this way, the improvement of waste land becomes a regular business, of the same nature with that of trade or manufactures, that a man may look up to with an assured hope of profit. It is in fact a species of manufacture itself ; and a manufacture too, which, being of a more beneficial tendency, de-

serves to be encouraged above all others. By its operations, employment is given to a great number of hands; and the persons thus employed, instead of being crowded into towns, (as in most other manufactures,) where their health is injured, and their morals corrupted by the infectious contagion of bad example, are allowed to retain the primitive simplicity of manners that the habits of a country life so necessarily insure; their whole exertions meanwhile are employed in augmenting the quantity of human food, and in adding, in the most direct manner, to the population and wealth,—to the internal prosperity and stability of the State. Should this kind of employment be encouraged, who can set limits either to the population, or to the productiveness of these kingdoms?

Illustrated by a practical example.—I wish to impress the mind of the reader with a strong conviction of the necessity of advert-
ing to the circumstances which pre-

vent similar exertions being made in that part of the island which is most susceptible of it, when compared with those that often occur in that part which is less favourably circumstanced. In the last situation, it is no uncommon thing for a man to expend at the rate of sixty pounds *per acre*, before he can bring his lands to be let to a tenant: the undertaker thinks himself abundantly repaid, if he can get three pounds of *gross* rent. In Scotland there are few or no deductions to be made from rent. The land tax, in this case, having been fixed before the improvement took place, when the land was worth next to nothing, is so small as to be of no account; and neither tithe, nor poors rate, nor any other parish taxes, are exigible from such lands; so that the whole of the gross rent the lands can afford, comes directly into the pocket of the undertaker; in consequence of which he draws a free annual income of 5 *per cent* for the money he has thus expended, and he is thus encouraged to proceed.

In England the case is different. There are so many deductions to be made from the gross rent the farmers pay, that the proportion of free rent which remains to the landlord, is much less than in the case above specified. An example will make this plain: Let us suppose that 60*l.* *per* acre has been expended, and that the productiveness of the improved land is equal in both cases; taking then the usual computation, that the rent of an arable farm should not exceed one third part of the value of its total produce; hence the total value of the crop in this case would be *nine* pounds *per* acre; the tithe of which, if drawn in kind, will of course be equal to 18 shillings. If the poor's rates, and other parish charges, be equal to 6 shillings in the pound, (and it appears by the surveys that these rates are higher in many places,) this upon 3*l.* of rent would amount also to 18 shillings; in all 36 shillings to be deducted from the original 3*l.*, which would leave a free rent to the undertaker in England of 1*l.* 4*s.* only, in-

stead of the 3*l.* in Scotland, which the tenant actually pays, and which the improver actually receives. At this rate, instead of the 5 *per cent.* he had actually drawn for his money, he would be entitled to draw in England only *two per cent.*: of course, that business which it might have been practicable to pursue, in the one case, with a reasonable profit, would be, in the other case, productive of the most certain ruin; and must be totally abandoned: and abandoned for what? Not for the benefit of the tithe-owner; for, in this case, the tithe-owner can never be benefitted by the land in question one shilling; nor for the benefit of the poor, who never can derive any emolument from it, while it is allowed to remain in its unproductive state: The power therefore conferred by law, to exact both these taxes, is calculated to produce only mischief. Doubtless it could never be the intention of the Legislature to authorise laws of such a pernicious tendency, with an intention to destroy, in such a direct

manner, the effective industry of the nation. It can only be ascribed to that kind of imperfection, arising from want of foresight, to which all human institutions are liable. It is experience alone that can discover evils of this sort ; but, after they are felt and pointed out, it is the province of a wise and beneficent Legislature to correct these oversights, and to redress the grievances to which they have given rise.

Lands to be appropriated in lieu of tithes, considered.—A device has been adopted in England, in *some cases*, with a view to mitigate the evil pointed out above respecting tithe. Where commons are divided by authority of Parliament, a certain proportion, usually I think one ninth part, of the soil has been set apart for the tithe-owner, in lieu of tithes from the whole. This doubtless does diminish the evil, because it at least allows the owners of the remaining eight ninths, to proceed with their improvements in as far as respects

the tithe. But besides that this remedy can only be applied in cases where a special Act of Parliament is obtained for the purpose, and therefore can never afford relief to those who might find a propensity to improve their own undisputed property, the cure itself produces a disease which is little less fatal, in many cases, than that for which it affords a remedy: nor does that remedy afford such a radical national relief as a beneficent Legislature should aim at.

It is very plain, that if the tithe-owner be a clergyman, the portion of waste ground allocated to him can prove of no emolument whatever. He has not the right to sell it for the trifle it would bring, in its present uncultivated state, were he even to find one who was willing to purchase it. The laws of the church prevent that. He cannot improve it himself; for, had he the money at command, common sense would prevent him from sinking a great capital of his own, with a certainty of being able to draw

perhaps not legal interest for it during his own incumbency, and, at his removal or death, to deprive his heirs for ever of the capital sunk on that improvement. This portion of the waste then is locked up from all prospect of melioration for ever; and neither can benefit the clerkman to whom it has been awarded, nor any other person.

All the reasoning above is on the supposition that the waste is of the very unproductive nature of the case adduced, and is merely illustrative: but whatever be the state of the subject in question, the same reasoning applies, *in kind*, though not in *degree*; as that will be varied by the productiveness of the soil, and other circumstances. This is indeed very evident; but I think it necessary thus to state it, to obviate the remarks of hasty inconsiderate cavillers, who, on an intricate question of this kind, may be expected to be sufficiently numerous. There are cases of a more favourable nature, which I need not here specially particularise.

• *The improvement of waste lands should be conducted by actual farmers.*—Though very spirited exertions have been made, in some cases, in the improving divided commons in England, yet, from the obstructions above stated, and others that will come under review in the sequel of this disquisition, the influence of these exertions has been much circumscribed, in comparison of what it would have been. Every agricultural exertion that is to be attempted by men who do not make a profession of that business, must be conducted with an uneconomical expenditure of capital, which would have been much diminished, had the operations been conducted by a professional man. It were unnecessary to add, that such expenditure tends to diminish the rate of profit on such enterprizes considerably below that which it otherwise might have been. This consideration plainly indicates, that in all cases where the expenditure required for cultivating waste lands is not beyond the faculties of the

farmer, such arrangements should be adopted, as to throw the burthen of these improvements upon him, if it be possible.

Apathy of farmers, circumstances which occasion it.—But, it is a pretty general rule, that persons, who follow the profession of agriculture, have little more money than what is barely sufficient to purchase stock for the farms they rent; so that it would be vain to expect that they could afford to make the advances for the amelioration of waste lands, that are *nearly* in the same state of unproductiveness with those above enumerated. Their highest views are, for the most part, directed to those immediate *annual* returns which can be got from their farms by means of home manures, and an economical arrangement of their domestic management, without looking forward to those national benefits that might in many cases accrue from their spirited exertions in meliorating waste lands, in proper circumstances. This kind of apathy I am far from imputing

to these men as an object of blame. It is a necessary consequence of that state of insecurity in which the prejudices of the times has contrived to place them. So far am I from blaming these men for their inactivity in this respect, that I should think them highly culpable, indeed, if they did adopt another mode of conduct; but of this there is little danger to be apprehended, so long as they shall be kept in that species of depression to which they are at present subjected; for common sense has wonderful power, when supported by necessity.

Insecurity of tenure stops the improvement of Wastes.—It may perhaps be deemed a tautology, but I hope to be pardoned for once more remarking, that leases, for an uncertain period, or for a small number of years, clogged with injudicious restrictive clauses, are productive of the same effect upon the conduct of the farmer. They all tend to produce a sordid kind of dependence upon superiors, which sinks

the spirits into a grovelling depression, that is perfectly destructive of that elevated ardour of mind on which every active pursuit must ultimately depend. Were farmers allowed a reasonable length of tenure, and were they at the same time freed from ill judged restrictions, the case would be very much changed in a short space of time. They would soon perceive that, from a judicious outlay of such money as they could command, towards the melioration of such soils within their reach as were susceptible of it, very considerable profits might be derived : this would soon produce astonishing efforts ;—for none but those who have particularly adverted to it, can conceive what energy the drawing a little profit, with the agreeable prospect of obtaining more, gives to the exertions of man. This rouses all the faculties, keeps the attention continually awake to mark every little circumstance and incident, and to turn it to advantage. When once put into this train, the farmer may be fairly left to

himself. Is he ignorant, he will soon acquire knowledge through a thousand channels that he alone can discover; and every day will add to his skill and his energy. It is impossible not to perceive, though it is unnecessary for me to state it particularly, after what has been said in the preceding essay, that the consequence of this energy must redound greatly to the emolument of the proprietor, and the productiveness of the country.

Inclosed lands may sometimes be called Wastes.

—It is not merely in regard to the improvement of those lands which are called *wastes*, in the common acceptation of the word, that the alteration above proposed would prove a great national benefit: There are many millions of acres, lying scattered throughout the different counties in England, which, though inclosed, and the property of individuals, may be fairly entitled, as I conceive, to the name of wastes; because they do not, in their present state, afford one fourth part of the

produce that they might easily be made to yield. These fields, by an injudicious system of management, having been laid down to grafs without being brought into a state of productiveness sufficient to allow them to admit of their being meliorated by that management, are now prevented from being broken up so as to bring them to a proper degree of fertility, and have thus degenerated into a deplorable state of sterility. Many of these fields, consisting of a poor thin hide-bound clay, produce only a very scanty quantity of four unwholesome grasses, which no domestic animal will eat, unless when at the point of starving. Others are covered with a full coat of fog, (moss) that excludes almost the very appearance of any other plant whatever; and others are so thickly overspread with ant-hills, as scarcely to let the appearance of the natural sward be seen in any part of the field. Under the unrestrained management of a person whose knowledge was improved by a sense of his own immediate interest,

all these crying abuses would be quickly corrected, and in a few years those fields, which are now a disgrace to the country where they are suffered to remain, would be converted into a fertile state, affording abundance of wholesome produce both for man and beast.

Were this judicious system of management universally adopted, the profession of agriculture, like that of manufacture or of trade, would be looked up to as an employment in which a moderate stock might be applied with a reasonable prospect of acquiring, by industry and good conduct, both a comfortable subsistence to one's family, and a moderate competence of wealth. In that case, a farmer would find it useful in general not to lay out his whole stock on cattle and implements,—for seed, and servants maintenance, as at present, but rather to reserve a part of that stock for the purpose of purchasing manures, making drains, embanking rivers, levelling high ridges, removing stones, grubbing up useless stumps or

brushwood, and other substantial improvements that the state of his farm might render necessary. He would not then be under the necessity of abstaining from such operations as could not make a full return to him *within the year*, but would find himself enabled to rest satisfied with such moderate returns as would only clear his capital to him *after many years*. In that case, there would be no need for gentlemen of great landed property trying to instruct their tenants in the proper mode of prosecuting their own business; for they themselves would search for it, and obtain that knowledge in a much more perfect manner than any other person could devise for them. Plenty would abound in every corner, if, with that superabundant plenty, a ready access to markets, on reasonable terms, be not prevented; and peaceful content would be the natural result.

Necessity of adverting to the foregoing circumstances.—Let not these observations be

accounted an unnecessary digression in this place. It is doubtless the intention of the Board of Agriculture, to point out to the public the most effectual means of rendering the waste grounds in this country productive to the State. Had I proceeded merely to give directions how these waste lands *may* be managed so as to be rendered productive, while I was conscious, at the same time, that there are thousands of honest farmers in the kingdom who know that part of the business as well as myself, and therefore stand in no need of such instructions, but who are prevented from acting because of the operation of the causes above assigned, I might thus have made a vain and idle display of knowledge, which might have tended to impress a few with an advantageous idea of my own acquirements, while these directions, like thousands of others that have been distributed with a lavish hand to the public, could have proved of very little avail. Applause, upon these terms, I shall ever despise. Before

instructions can be of real utility, circumstances must be such as to render it practicable to carry them into effect ; so that, without adverting to the circumstances above stated, I consider all that follows merely as words of no effective importance, which I should never have taken the trouble of putting upon paper, as it would be only a painful exertion without any beneficial tendency. In hopes that men may be put into such circumstances as to be able to avail themselves of the hints that follow, which are the result of a pretty extensive practice in the melioration of waste grounds, I shall communicate them to the public with pleasure, conscious, in the first place, that they will not prove a snare to those who are ignorant ; and that they may, perhaps, in some cases, prove useful even to those who are better informed.

§ II.

*Practical directions for bringing waste lands
into cultivation,*

1st, As connected with a cultivated farm.

THE most favourable circumstance for the improvement of waste land, by those exertions that are within the reach of a farmer, is when the waste is in the near vicinity of an arable farm, and connected with it. In this case, the farmer, by a small addition to the strength of his labouring animals, can annually cultivate a portion of the waste land without much inconvenience to himself. Many are the advantages arising from this arrangement: The expence of erecting new houses is avoided; food for sustaining his labouring cattle is already within his reach; which, on a compleat new undertaking on waste lands, is an obstruction that is extremely difficult to be surmounted; a

strength sufficient can be spared to labour the waste ground that is under cultivation, or in its progress towards it, at once, when the proper season requires it, while the servants and horses have employment at seasons when they could not with propriety have touched the new ground. Lime or other manures can be brought in abundance for the newly cultivated fields, at the season of the year when circumstances render it otherwise most convenient; manures can be afforded from the farm, for bringing the waste more quickly into tilth, than in other cases. In short, there are a variety of other lesser circumstances, which all tend to smooth the difficulties that would otherwise be experienced in an undertaking of this sort.

How to bring waste lands as soon as possible into the state of profitable grass lands.—The object that an improver of waste lands ought to have chiefly in view, should be, to have it laid down into *profitable*

grafs land as soon as that can be *properly* accomplished ; for the moment it is laid into grafs, in these circumstances, it ceases to be a burthen upon the operator : it no longer requires manures, but rather furnishes manure to the less improved fields ; and affords, at the same time, food for the beasts that are required for the proper management of the land.

But do not omit to observe, that it ought not to be laid into grafs, until this can be *properly* done. No ground can ever be laid into grafs with a judicious attention to economy, but when it is in a state of great productiveness and high *tillb.* I know not any one branch of husbandry in which more people err than in that which respects the laying down ground into grafs. When agriculture was in its infancy in this island, an idea seemed to prevail that no ground, which ever had been under tillage, should be laid down to grafs, so long as it was capable of producing a crop of grain that would pay for seed and labour. That

notion is now pretty much exploded; but even at this hour, there are only a few persons who are sufficiently aware of the very great difference of profit that the farmer is able to draw, in the course of a series of years, from a field laid out to grass, in the *richest state possible*, or in moderate condition only. Were I here to state this particular to the *full extent*, it would appear to be exaggeration, for which reason I omit it: but I hope the inexperienced reader will take my word for it, when I say that it is much greater than he can easily imagine; and that, therefore, he should be very cautious never to lose sight of this maxim, in his attempts at reclaiming waste lands.

The necessity of not attempting to do too much inculcated.—To obtain that high degree of fertility as quickly as possible, the undertaker should be cautious not to push forward with his improvements faster than the circumstances he is in will permit: And, in particular, never to go beyond

the bounds that the manures he can command are sufficient to accomplish *completely*. More people have been ruined, in enterprises of this sort, by attempting to do *too much*, than by any other circumstance whatever. There is something so pleasing in the idea of going forward with rapidity, that many sensible men have been seduced by it to their own undoing. "Do what you do *completely*," is the maxim of wisdom in this case. If you can do twenty acres well in a season, good, go on with it. But if you are stinted in manures, go just as far as they go, giving a full, rather an under allowance; but go not an inch farther. If these cover ten acres, five acres, one acre only, seek to do no more. This will repay your expences fully, and afford you pleasure as well as profit. But to bestow much labour and expence on a large surface of unproductive soil, is attended with great waste of funds; and the hungry appearance of the crops is irksome to behold.

Lime, the most universal manure for unproductive lands.—Of all the manures that can be obtained for improving waste lands, nothing is equal to lime, or other calcareous matters. In every undertaking of this sort, therefore, the first consideration ought to be, where can lime be obtained, * at what price, and in what quantities? Unless this, or some other calcareous manure, can be obtained in sufficient quantity, and at a reasonable price, I should consider the improvement of an unproductive waste of considerable extent, as a very hopeless undertaking: but where that manure can be obtained in abundance, and at a cheap rate, there are very

* For the sake of brevity, I mention *lime* only in the text; but the same observations will apply to any other calcareous matter, of equal purity, that can be obtained: Of these, shelly-sand, and shell-marle, are the most easily divisible, and, where free from extraneous mixtures, are nearly equal in value to lime. Chalk is a pure calcareous matter; but is not so easily divisible; and clay-marle is often impure, so as to require to be applied in very *large* quantities to produce a sensible effect. All these substances operate nearly in the same way.

few soils so barren, as, under a proper management, may not by degrees be very much meliorated.

But lime, *on poor* soils, is a trifling and inefficacious manure, unless where it is applied in *very considerable quantities at once*. A chaldron, or half a chaldron *per* acre, I should consider as nearly as efficacious, in this case, as sprinkling a pinch of snuff. Six hundred bushels of slacked lime *per* acre, I should consider as not an over-dose; and less than three hundred I should account too little, in almost any case.

Great as this quantity of manure may appear to some persons, I should by no means consider it alone as an abundant dressing for poor ground newly broke up from waste fields. To bring it into the proper heart, I would require, if it *can be obtained*, from 50 to 60 cart-loads of yard dung, as much as two horses can properly draw upon plowed land *per* acre. With this dressing, if the ground be brought into proper tilth, the soil will be very indifferent, indeed, and subjected to bad ma-

nagement, if it be not made fertile for ever.

Dung ought to be conjoined with lime.—Many persons will think it unnecessary to employ both dung and lime at the same time, as they would think that either of them separately would be sufficient. This is upon the *starvation* system, which I consider as the bane of farming. The fact is, that when lime and dung are thus conjoined, † they produce more powerful aggregate effects, than if either had been separately applied: so that much benefit results from this practice. Lime, as I have elsewhere said, ‡ acts both as an alterative and a fertilizer. In its alterative capacity, it not only enables the soil to produce crops it never otherwise could have yielded; but it also enables dung to operate upon the soil, in a manner it never other-

† I do not mean to say mixed together, before being used, but only applied in the same season.

‡ Agricultural account of Aberdeenshire, and Essay on Quick-lime, as a manure, in the first volume of these Essays.

wife would have done. Of the two, lime alone is better than dung alone, on unproductive soils. I have seen some soils on which dung alone produced very little effect.*

To apply these manures, then, in *great quantities together*, is beneficial; but it is chiefly beneficial, if care be taken not to exhaust the soil after it has been thus enriched, before it be laid down into grass. This I hold to be a fundamental maxim in farming,—“Where you have waste grounds to improve, take the earliest opportunity you can to enrich your ground to the full; and when you have it so enriched, and brought into proper tilth, lay it down immediately into grass, to remain in that state till you have brought the whole of your fields into the same condition.”

* Heath-ground, in general, and mossy soils, though they may, by dung alone, be made to produce an abundant crop or two of corn, revert in a short time nearly to the same unproductive state as before, the former returning to heath, and the latter too often affords little else than sorrel.

Newly broke up land should be kept under tillage for some time, and old corn land laid into grass.—But before ground that has been broke up from the state of wastes, can be laid into grass with full advantage, even after this abundant manuring, certain precautions are necessary, which ought by no means to be overlooked. Most land that never has been cultivated is, to a certain degree, in a sour crude state, that renders it unkindly for the production of *grass* in a special degree. To fit it for that purpose in the most perfect manner, frequent plowing, long exposure to the air, and repeated dungings, are required. In the situation here described, this can often be done by converting part of the old arable farm into grass, and continuing the new broke up lands for some time in tillage, under a judicious rotation of crops, and an enriching system of management. This system of making an interchange between grass and corn land, is extremely beneficial; for old corn land, that has become unfit in

some measure for the production of healthy grain, and abounds in destructive weeds, which are extremely prejudicial to the farmer, is in the very fittest state that can be devised for the production of fine grafs, on the supposition that it gets a proper dressing to free it from root weeds, and is abundantly enriched with manure at the time; and newly broke up land, under a proper management, is, on the contrary, much better fitted to produce healthy, firm, and luxuriant crops of corn than grafs.

Summer fallowing,--uses of it.--But as it may frequently happen that manures, for keeping the ground under crops for a length of time, cannot be obtained, it is necessary for the cultivator to try to bring these crude soils into a proper tilth for grafs, as quickly as possible; and his operations must be adapted for that end. Summer fallow is the most obvious measure for this purpose; and, in most cases, the operations must be commenced by that pro-

cess. If the soil be very mellow, and the season favourable, perhaps it may be possible, if the ground be broke up early in the season, to get it reduced so far in the beginning of summer, as to admit of its being sown with turnips that season; but this will seldom be the case, and, in general, it will be better to give it a complete year of fallow first, and content yourself with taking a crop of turnips the second season only, by which time the field will be reduced to that husband like state which a good farmer ought ever to aim at.

Deep stirring of the soil, importance of—In whichever of these ways the ground is to be managed, it ought to be an invariable rule, to make the *second* plowing as deep as the nature of the soil and other circumstances will admit. If the subsoil be retentive, and the stratum below of a good quality, especially if it be better than that which lies on the surface, (which is a very common case where heath abounds,) it

ought, on this occasion, to be opened up to the depth of twelve inches at least ; and, if it be to fourteen or sixteen inches, the soil being still good, so much the better.

Trenching, its utility.—No plough, in such stiff soils, will be capable of going to such a depth at once ; and therefore reliance must be had upon other aids for that purpose. Where stones are at all to be found, this operation will be best performed by a clean trenching with the spade. Where stones are wanting, and the mold moderately friable, it may be done by means of two strong ploughs, the one following the other in the same furrow. In this case, the first plough must have its mold-board so set as to make a very wide furrow ; and the plough that is to follow it, ought to have a narrower mold-board, so as to lift up the earth, loosened by its share, to the top of the other furrow. But if the bottom be stiff, and there be any obstructions, instead of the second plough, it will be more adviseable to have it done by

the spade. To do this, the whole length of the furrow should be divided into equal portions, and allotted to different men, each person being obliged to have his portion cleared out by the time the plough comes round. This is not a very expensive operation ; as I have found that from six to ten men, in proportion to the hardness of the soil, and the alertness of the operators, will be sufficient to loosen the bottom as fast as one plough can turn over the surface.

The Miner, its uses.—But where the surface soil is better than that which would come to be turned uppermost by the trenching process, especially if that difference be considerable, it may be prudent to omit it ; but never omit the opening the soil to the proposed depth, if it can be done at all. In this case, it will be advisable to make use of an implement that has been lately introduced into Lancashire, under the name of a MINER. It is a strong kind of plough, having a share

only, without a mold-board for raising the earth; so that it loosens, without turning up the soil, (and to do this the more effectually, sometimes two shares, or coul-
ters, [cutters] are added.) This imple-
ment is made to follow the plough in the
same furrow, so as to penetrate to a con-
siderable depth below the bottom of the
furrow. I consider this to be one of the
most useful implements that has of late
been introduced into the practice of ag-
riculture, which every farmer, who has a
soil capable of admitting it to work, should
have.

*A particular kind of wet soils, how to drain
and cultivate.*—I am thus particular in ex-
pressing a solicitude about this deep loos-
ening of the mold, because I have remark-
ed innumerable bad effects that have re-
sulted from the general want of attention,
which prevails throughout every part of
the island to this particular. Where the
mold has only been opened to the depth
of a few inches above a stiff clay, or other

retentive subsoil, observe the consequences ! Whenever rain falls in great quantities, a great part of it must be quickly carried off, or the soil will be drowned, and rendered unfit for the purposes of vegetation, in whatever state it may be in other respects. For this reason, every farmer is aware of the necessity of having a sufficient number of open furrows upon all retentive soils, for carrying that superfluous water as quickly and completely off the ground as possible. This water flows partly along the surface, until it falls into the furrows, and it partly sinks through the mold till it reach the furrow ; but unless it be during very heavy dashes of rain, the greatest part of the moisture sinks gradually through the pervious mold, until it meets with the impervious substratum that lies below it. When the water reaches that substratum, it forms a kind of subterranean lake, which finds no issue, until by its gravity it forces for itself a passage laterally through the crannies of the mold, until it at last reaches

the open furrows prepared for that purpose, which afford it then a ready outlet, through which it can flow off the ground. In these circumstances, it is obvious that the portion of the mold which lies immediately contiguous to the substratum, must be, for some inches in depth, more or less in proportion to the quantity of rain, and the tenacity of the soil, in a state of bog or watery quagg, that is unfit for sustaining any of those plants which it is the aim of the husbandman to cultivate in this climate. In this state, too, the mold there being so long soaked in water, and so frequently drenched by it, must have every material it contains that is soluble in water compleatly washed out of it in a very short time, and its particles so frequently and thoroughly soaked, as to reduce it to a kind of paste, fitter to be converted into a brick on drying, than to become a friable mold. If the earth be loosened by the plough, only for a few inches depth on the surface of such soils, the whole of this pasting process must take place among

the only mold in which the plants that grow upon it, can seek their nourishment ; so that this soil must be at one time in the state of a pap, that would be too thin for the mortar in a mason's tub ; and, at another time, it must be as dry, and nearly as hard, as a sun-made brick. In this condition, what sort of crops can be expected of any kind ? It is this sort of management which, for the most part, is the cause of that kind of starved unproductiveness of soil, which is known among farmers by the name of *bide-bound*, which many men believe it would be throwing away money to attempt to reclaim. And it is certainly true that, so long as men shall continue the practice of such scratching of plowing, they judge rightly. But under the system of management above described, many of these soils may in time be rendered amongst the most productive in the island, and with great profit too to the judicious operator.

When the foil is opened up by the processes recommended above, it is rendered pervious to water to the whole of the depth to which it is loosened ; while at the same time the water is allowed to find its way off the ground at a depth so far below the surface, as not to injure that portion of the mold in which the principal roots of the plants abound. Indeed, a great part of that moisture, in these circumstances, never finds its way off the ground at all ; but soaking gradually downwards, that water, which, if it had only been allowed to sink three inches, must soon have reached the bottom, and there have been regorged back upon the foil, will require at least five times as long a period to sink to fifteen inches deep, and in its progress will be only gradually moistening, instead of drenching the foil ; so that if the rain shall subside before it has reached the bottom, no part of that water will be carried off the field, unless what flows over the surface ; but it will there remain to moisten the earth

only to a salutary degree, and, like the water in the stomach of the camel, will afford a supply when drought comes on and parches the surface of the ground: for the deep fibres of the roots penetrating downwards, there will find moisture, which those near the surface would then be deprived of. Thus does the practice recommended operate alike as a cure for the excess of wet as of drought, and produces a healthy vegetation in all circumstances. One would wonder that seeing the effects of this process so universally in our gardens, to which these owe in a great measure their superior degree of fertility,—men should so seldom have adverted to the benefits they would derive from the same process being extended to the fields. They see that in gardens, even where the soil is very retentive, good crops are produced without water furrows at all, whereas, in fields of the same nature, they know that nothing of this sort could be expected. The rationale of this phenomenon being now explained, it will be no longer a mys-

tery to any one; and it is to be hoped the Board of Agriculture will pursue such measures as shall render it practicable for the agriculturist to adopt it universally, where necessary; which it certainly is not in his power to do, throughout the greatest part of England, under the present system of management.

Deep plowing, on ordinary occasions, not necessary.—But though the benefits to be derived from the opening up of the soil to the depth proposed be very apparent. I conceive it by no means necessary to attempt to plough, on ordinary occasions, to a great depth: On the contrary, unless it be for very particular purposes, if the *miner* be from time to time employed for loosening the soil to a proper depth, I am satisfied that shallow plowing would be, for the most part, more beneficial than the reverse. In that case, the surface soil, in which all seeds must germinate, and draw their nourishment for a considerable period of their growth, will be rendered

much more fertile by the same quantity of manure, than if it were mixed with a much greater depth of mold ; and as it is known that the fertilizing qualities of all manures are carried downward by moisture, where the soil is so porous as to admit of a slow absorption of that water, that under-soil will be gradually becoming more fertile by this process, which will still tend to nourish the crop. From these considerations, instead of advising the manures to be buried to a great depth, by very deep plowing, I should much rather recommend, when the trenching or mining process is connected with it, that the plowing should be of a moderate depth. Though on retentive soils, where that practice is omitted, deep plowing is doubtless extremely necessary.

Lime ought to be spread while in a dry powdery state.—In every case, the sooner the lime is laid upon the soil, after the trenching process has been completed and the surface smoothed, and the more quickly

and intimately it can be blended with the mold, the better it will be on every account. For as the lime never acts till it becomes blended with the soil, and acts the more powerfully in proportion as this mixing is the more compleat, it should be applied as early as possible, that it may have the full benefit of the subsequent plowings for blending it thoroughly. For the same reasons, the lime should always be spread while it is yet in its dry and powdery state, and should be plowed or harrowed in as soon as possible after it is spread, to prevent it running into clots by moisture; as these become afterwards stoney masses that never can be properly divided. I take notice of this circumstance specially, because I have observed that it is a very common practice to lay down lime that has been brought home in the state of shells, in heaps to slack by the air; in which case, it seldom fails to be converted into the clotty state I here reprehend; and in which it will not produce the same effect upon the soil that

half the quantity of lime, judiciously applied, would have done. To lay down the shells where water can be had for slacking them, and driving the lime to the field as soon as slacked, can usually be done at a small additional expence, which will be repaid more than an hundred fold by the superior luxuriance perhaps of even the very first crop only : so that the contrary practice is extremely uneconomical.

Turnip a proper crop for unmellowed soils.

—No crop succeeds better on harsh unmellowed soils than turnip. Perhaps it thrives better on these, with a sufficiency of manures, than on those soils that have been long under cultivation. This is therefore the best crop for the *first* on all newly broke up wastes, that are not of too clayey a nature. It not only mellows the soil even perhaps more than a fallow, but affords a great deal of dung, which is an article of inestimable value in enterprises of this kind. It is a great mistake to

suppose that turnips will grow only upon light land : they thrive exceedingly well on stiff loams. Even upon clayey soils, as good turnips can be reared as on any other, particularly the Swedish kind, called *ruta бага* ; * but the difficulty of car-

* Perhaps turnips can be reared to a larger size on clayey lands than any other, if merely the rearing them to a greater size were to be adverted to ; of which the following well authenticated fact will afford a sufficient proof. Mr Campbell of Shawfield occupies a farm at Woodhall, near Glasgow, consisting of a strong clayey soil, upon which he had some turnips last season (crop 1795,) of a size that attracted the notice of every person who saw them. One day an argument having arisen among the gentlemen at table, about the greatest weight to which a turnip could be raised, and opinions varying very much on this subject, Mr Campbell ordered one of the largest of his turnips to be pulled and weighed. This was done ; and most part of the company were very much surprised on finding that it weighed full *forty* pounds. On searching, however, with greater care, through the field at a future period, when they had attained a greater growth, one turnip was found which, when perfectly cleaned from earth and rubbish of any sort, weighed SIXTY THREE POUNDS AND A HALF. This turnip was kept for some time, and repeatedly weighed before many different persons ; among the last of whom was the Duke of Argyll, who saw it weighed some weeks after it had been taken up, when it was

rying them off from such soils is an objection to their culture on that kind of ground §. By consuming the turnips in the end of autumn, and early in winter,

found to have lost just half a pound; it weighing then no more than sixty-three pounds near. Many persons are now alive who saw this turnip weighed, and can correct me if I misstate the fact, which I should not have ventured to do, but upon *the very best authority*; for it is so great that I am sensible it will occasion some surprise. I record it here with satisfaction, for two reasons; first, because it affords the clearest proof that turnips can be reared well on clayey soils, as I have often experienced; and second, that turnips are reared in Scotland to a larger size in general than perhaps in any other country, as I had ventured to hint at in the agricultural survey of Aberdeenshire, published by the Board of Agriculture.

§ Turnips may be carried off even a clayey soil, without poaching it, by the following contrivance. Let the turnips be sown in drills at a convenient distance for horse-hoeing, say three feet, and let them be properly earthed up for the last time to as great a depth as the plough can go; let care be then taken that no clods be suffered to remain in the bottom of the furrow, to detain the water when rain falls. If this be carefully attended, the rain will run clear off as soon as it falls; and that wet poachyness, which is frequent on such lands, will be in a great measure prevented. Let no animals of any sort come upon the

this inconvenience may be greatly diminished ; and though the profit to be derived from them, at that season of the year, is less than if they could be reserved till farther on in winter, it deserves to be well considered whether this crop, with all the inconveniences attending it,

field after this last hoeing, till the turnips are to be carried off.

Have a cart provided, of the nature of a waggon, having three wheels, two on one end, placed at six feet asunder, and one at the other end, exactly in the middle line of the cart ; of course the two first wheels will stretch over two rows, and the wheels go exactly in the outside furrows of these ; the other wheel will go in the furrow in the middle that divides the two ridges. This cart may be drawn by one horse, or by two, one before the other ; the horses will go in the middle. In this way, neither the horses nor the wheels will touch the plowed land ; the cart being introduced at one end, and drawn along the course of the same ridges as far as is necessary for loading the cart. When it is loaded, the horse or horses should be unyocked, (the cart resting as a waggon on its wheels,) and turned about, be then yocked at the other end of the cart, and so return in the same tract in which they came. Care should be taken, in general, to draw the loaded cart down the hill, not only because of the easiness of the draught, but also because the wheels will make a clear tract, to serve as a good water-furrow afterwards.

may not be more beneficial, in the particular case under consideration, than any other.

Turnips should be sown early.—In all cases of this nature, the turnips ought to be drilled, and thoroughly horse-hoed. The dung should be applied in the drills immediately before sowing. It is unnecessary to be more particular here, in regard to the culture of this crop. I shall only barely observe, that it is of great use, in every case of this nature, to sow the turnips very early in June; as thus the crop will never fail to be much larger than if sown later. The apprehension that early sown turnips run sooner to seed in the spring, than those that were sown later, is a mere groundless chimera, that has too long disgraced our books of agriculture. If turnips do not shoot during the summer in which they are sown, (which will seldom happen, if not sown before the middle of May,) they will be just as late of shooting

in the spring, as if the seeds were sown in August or September.

Two crops of turnips may be taken in succession.—Turnips are so useful an article in improving waste lands, that, in many cases, it may be adviseable to take even two crops of these in succession, from the same land, one year after the other. This will reduce it into fine tilth, and render it in excellent condition to be laid down with grass seeds, along with the first corn crop.

Pease or vetches may be sown on stiff soils.—Where turnips cannot be ventured, pease or vetches may be adopted in their stead. This never should be attempted, except in stiff soils : And here, those kinds which run much to haulm should be preferred. The longer the lime has been applied to the ground, and the more thoroughly it has been mixed with the soil before the turnips are sown, the better. The dung should be plowed in with the seed furrow. The seed may be either

drilled or sown broad cast ; but if there is no danger of their failing, broad-cast is fully as adviseable. Potatoes also may be advantageously reared as a first crop from waste lands, in many cases.

Oats succeed well on crude soils.—The culmiferous crop that succeeds best on unmellowed new ground, is oats. If the ground has been sufficiently manured, this crop will seldom fail to be an abundant one, even where the culture has not been so perfect as could be wished. If the soil has been made very mellow, barley will also succeed tolerably. Rye, I have been told, does very well, and may on some occasions be adopted, where a market for it can be found ; but, upon the whole, oats will, in most cases, prove the most profitable crop. It frequently happens in England, that *wheat* is sown for the first crop, after even an imperfect fallow. No farmer can surely stand in need of directions how to manage ground that can produce a good crop of wheat under these

circumstances. It is a severe reflection upon the country to say, that any land, of a quality that can afford a tolerable crop of wheat in these circumstances, should have been suffered to remain till our time under the disgraceful denomination of wastes.

Grass seeds should be sown with the first corn crop.—Along with the first corn crop where the improver of waste lands has not the conveniency of an adjoining farm to permit the newly cultivated lands being continued for some time in corn, as already specified; grass seeds should be sown, with an intention to allow the field to remain in grass till the whole portion of waste has been brought under culture. After which the skilful farmer, if he see it necessary, may go over it with a second series of dressings to make it still richer grass than before. But it is foreign to our purpose, to pursue this process farther in this place.

The kinds of grafs seed I would advife to be fown in thefe circumftances, are white clover, (ten pounds,) yellow clover, (ten pounds,) and clean rye grafs feeds, (two bufhels per acre.) If yarrow feeds were to be bought, I fhould advife four or five lb. of thefe to be added ; diminifhing, in that cafe, half a bufhel of the rye grafs : and if it were fpongy moffy land, tending to damp, fix or eight lb. of rib grafs may be fubftituted in place of fo much of the yellow clover. The poa graffes, and fome others, are good ; but there is a difficulty in procuring the feeds, which I fear will not be eafily overcome.

My reason for omitting red clover is, not that it would not prosper in fuch foils : for in thefe circumftances it would thrive very well ; but becaufe it is a fhort lived plant, and foon dies out ; and as its broad leaves, where it does thrive, overfhadow the other graffes, it is apt to choak them ; fo that when it wears out, it leaves the foil bare of plants, which encourages weeds and ufelefs graffes to come up in

its stead : but as it is an excellent grass for foiling horses, if cut and used green during the summer, as much ground may be sown with red clover as shall be sufficient for their use, if the undertaker so incline ; but never omit a small sprinkling of rye-grass among it, which will not only augment the quantity of produce, but also bring it some weeks more early in the spring than it would have been.

Rye-grass recommended.—I am also aware of the aversion that some persons have against rye-grass : but as I am satisfied, from long experience and accurate observation, that there is no sufficient foundation for this prejudice, I should think I betrayed the trust reposed in me, did I allow it to influence me on the present occasion. Besides the recommendation of this grass, from the facility of obtaining its seeds, it has so many other valuable qualities to recommend it, that I consider every circumstance which tends to

circumscribe its use as a national misfortune. It is a grass that is liked almost by every domestic animal above all others. It springs up very early in the season, furnishes a vast abundance of herbage, and thrives on almost every soil. On very poor lands, indeed, it produces a much more scanty crop than on such as are richer ; and on all such occasions, if it be not eaten down very close in the beginning of the season, it is apt to run up to seed ; after which the stalks, like the seed stalks of every other kind of *gramen* I know, are disrelished by cattle. Under the management of a sloven, then, it may be allowed to run to waste ; as the best pastures even in Romney marsh may be also, if not adverted to in time ; to the great detriment of the owner. But if it be hard enough stocked, especially *in the spring*, which is not a matter of great difficulty, it will continue to afford sweet and succulent herbage throughout the whole remaining part of the season : so that he who suffers by this neglect has only himself to blame,

and not the plant he has injudiciously cultivated.

Some persons will perhaps think the quantity of seeds above recommended, more than necessary. Certainly less might do; but experience has taught me that, on an average, more profit will be derived from this abundant seeding, than the reverse.

The practice of sowing all kinds of rubbish promiscuously, under the name of *bay seeds*, is now so universally exploded, by all sensible men who have had opportunities of being fully informed, as renders it unnecessary for me to say any thing particular on that head.

Burnbating, cases in which it may be successfully adopted. — Where the surface of waste grounds to be improved is covered with a thick coat of the *nardus stricta*, and other dry benty kinds of grass, it will often prove beneficial to pare and burn that surface; and, therefore, in these circumstances, a good economist ought not to

overlook this mean of forwarding his operations. I am no stranger to the prejudice that prevails among many writers of the present day against this practice; but this, I conceive, in a great measure owes its origin to hasty observation, which does not admit of discriminating fairly between the proper use and the abuse of this practice. It is an undoubted fact, confirmed by the experience of many practical farmers, that on many poor soils, a crop may be thus obtained much more abundant than could be obtained without it. This fact, and it is an important one, is admitted even by those who oppose the practice. It is well known by every practical farmer, that an abundant crop of any kind, under judicious management, is one of the most certain means of laying the foundation for future crops; and in cultivating waste grounds, it is a great point gained to obtain a good crop at the commencement of these operations.

Burning does not consume the mold, nor change the soil of waste grounds for the worse.—As to the idea, which seems to influence the opinion of many of these writers, that this practice tends to destroy the soil itself, and thus to render it thinner than it would be, it plainly originates from misconception ; and is directly contradicted by experience. No kind of earth, properly so called *, is capable of being consumed by fire. All that the fire does, in the process of *denstring*, or *burn-beaking*, as it is indiscriminately called, is to consume the dried vegetable fibres which were intermixed among the soil ; during which process a small proportion of alkaline salt is generated, which is known to act very powerfully as a manure ; and the earth that was entangled among these roots, in consequence of the incineration, is dried, and reduced to a powdery state, but neither is destroyed nor reduced in

* *N. B.* I exclude peat earth, commonly called *moss*, from the class of earths properly so denominated ; so that it is to be here considered as an exception.

quantity. The qualities of this earth may, indeed, by this process, be sometimes a little altered; but, in the circumstances here stated, that alteration, it should seem, could seldom be for the worse. The kind of earth that is the most altered by the action of fire, is clay. Instead of remaining susceptible of being very much softened by water, clay, by this process, is rendered incapable of being thus acted upon. A small proportion of powdery brick earth thus obtained, mixed with the retentive mold, has evidently a beneficial tendency to divide it, and render the soil more mellow. These, and other considerations, make me lean to the side of experience, in this case, with less difficulty than I otherwise might have done; and I should have no hesitation in recommending the practice as beneficial, in the circumstances above specified.

The surface only may be burned, though the soil be deep plowed.—The greatest objection to it, in this case, is the difficulty of stirring

the mold to a sufficient depth before the incineration is effected; for experience universally confirms the propriety of giving only a very slight plowing after that process, before the seeds are sown. To effect both these purposes at once, a skim plough might be easily contrived, which should pare off the surface where the ground was free of stones, to a moderate thickness, and, by having a horizontal ledge projecting beyond the bottom of a part of the mold-board, thus carry the thin swardy surface over the *open* furrow to the right hand side, and lay it on the top of the earth that had been turned over beyond it, as shall just now be described. After the surface has been thus pared off and disposed of, another plough should follow in the same tract, and turn the bottom earth over into the open furrow, on the right-hand side, as in common plowing; and this may be deepened by the spade, or otherwise, to any degree thought necessary, without burying the sward in the smallest degree. By this

mode of management the sward may be dried and burnt perfectly well, and the earth be properly loosened at the same time. If that sward be properly burned and spread in due time, and if lime be mixed with it, and slightly plowed in for turnips, an abundant crop will thus be obtained the first year, without any dung. This good crop of turnips will afford a great quantity of dung, while the soil will, in the meantime, be more mellowed than if it had been left under a bare summer-fallow. If the same field be next year dunged and sown with turnips, it will afford a still more abundant crop; and the soil will by this time be reduced into the most excellent tilth for being laid into grass with the succeeding corn crop; after which it must be the farmer's fault, if ever in future it can be put out of order. It is not, however, my province here to proceed farther in the mode of management of such lands.

Burning old corn land may prove hurtful.
 —But although I consider the practice of burning the surface of barren *waste* soils, which are not of a mossy nature, wherever the plants on the surface are abundant, as exceedingly beneficial, I confess I have my doubts about the propriety of extending this practice to such soils as have been already fertilized by manures and brought into proper tilth. All kinds of earth, though they be in their original state, when dug from a great depth, infertile, become more fertile by degrees, on being exposed to the air on the surface, when impregnated by manures, and the gradual rotting of the roots of plants that grow upon them, along with the intermixture of the remains of animals which die there. They are thus in time converted into that kind of substance which we call *vegetable mold*. This vegetable mold, then, is neither a simple earth, nor a mixture of any number of simple earths together. But it is such a mixture, impregnated with the remains of animal and

vegetable matters united with them. These remains of organised bodies communicate something to the soil of an apparently oily or mucilaginous nature. Along with the fertility which it is seen to acquire, these give it a more friable texture, and a greater facility than it originally possessed, of absorbing water in a proper manner, and retaining it to a certain degree. Now, there seems to be little reason to doubt that fire tends to alter, destroy, or dissipate this mucilaginous quality which the mold derives from the spontaneous corruption of organised bodies. So that wherever the soil has been gradually fertilized by this process, there seems reason to fear that the burning of its sward will rather prove hurtful than beneficial.

But while I thus develope, as clearly as I can, the reasons that would make me doubt of the propriety of the practice of burning, in these circumstances, it is proper the reader should be at the same time warned that these are only reasons

for doubting, but by no means rules for practice. Practical rules should on all occasions be deduced from well authenticated facts alone; and I have had no opportunity of meeting with any facts I could rely upon, that either tend to confirm or to refute this mode of reasoning. I give it, therefore, as merely hypothetical, and as serving to direct the attention to a proper object of experimental enquiry, and nothing more. Human reason is by far too fallacious a guide to be relied upon in matters of this kind, as a *practical director*; though it is an excellent assistant for leading the mind into a proper train of investigation.

Burning mossy soils, a dangerous practice.—

I do not speak with the same reserve in regard to the impropriety of burning *mossy* soils; of the very hurtful tendency of which I have had innumerable practical proofs. In this case, it is not the plants which grow upon it, but the very substance itself that served as a soil on which

the plants grew, that is totally destroyed by incineration. This substance is, by burn-beaking, amazingly diminished in quantity; and the little that remains, instead of soil, after this destructive process, is an inert earth, which is more unfit for the purposes of vegetation than any other that has ever fallen under my observation. I therefore consider the burning of this kind of soil as in all cases pernicious; but particularly so, where there is no certain means of easily stopping the combustion, after a thin paring of the surface-sward has been consumed; and to stop it just there is, I know, a thing that is next to impracticable. For the proper means of meliorating peat, and converting it into fertile soil, I beg leave to refer the reader to a practical treatise on peat moss, lately published by me; as it would take up too much room to recapitulate the whole process in this place. It is only necessary here to observe, that of all the kinds of barren wastes, the improvement of this variety, under a judi-

cious system of management, can be effected with perhaps less difficulty than that of any other.

Stiff clayey soils difficult to be brought into cultivation.—The most hopeless soil for an unlucky adventurer to begin to work upon, while it is yet in a rude and unproductive state, is that of a stiff, coherent, obdurate clay. This kind of soil, though it be physically capable of being rendered perhaps the most productive of any that can be found; requires, when in a poor state, such nicety of management, such repeated additions of manures in vast quantities, and such an enormous expence in the cultivation of it, as to make any man of sound sense hesitate about engaging in attempting to improve it at all, unless under very particular circumstances. When circumstances, however, are favourable, it may be sometimes done under the care of a very skilful operator, with great advantage.

The expence of cultivating such soils often proves ruinous.—In every possible combination of circumstances, where a *whole farm* consists of this kind of soil, it must be managed at a vast expence. On account of the stiffness of the soil, the implements of agriculture must be strong and weighty, and, of course, the strength required to draw them must be great. But this is not the worst evil. On account of the necessity of catching the most favourable *tide** for labouring the soil, or of loof-

* In a practical treatise of this nature, it is impossible to avoid using technical phrases, without employing great circumlocution. But technical phrases are sometimes of a local nature, and in danger of not being generally understood. The words *Tilth* and *Tide* may be of that nature, for which reason they require to be explained.

Tilth has always a reference to the state of the soil respecting manures and culture. When it is richly impregnated with manures, and well divided by means of good culture, it is said to be in good *tilth*; or in bad *tilth*, when the reverse.

Tide has always a reference to the state the soil has been in, chiefly as respecting wetness or dryness at the time of labouring. It has been found by experience, that whatever state ground may be in at a particular time, as

ing the whole crop, the time of plowing is limited to a very few weeks only ; so that to perform the same quantity of work upon this kind of soil *in a proper manner*, will require more than *ten* times the number of servants and beasts of labour, that would be wanted on a farm of equal extent, consisting of light friable mold : so that if the operator has not some other way of employing his force in the intervals, they must be idle ; which will soon eat up the profits that can be derived from the most abundant crops. To diminish this expence, the unfortunate operator sometimes finds himself tempted to try to labour his ground when it is *not* in the most

to *tilth*, if it be laboured when very wet, or subjected to a deluge of rain, under particular circumstances, immediately after plowing, the effects of the former good culture will in a great measure be destroyed ; and the succeeding crop, which, if this stirring in improper circumstances had been avoided, would have been abundant,—will, in consequence of this circumstance, be very poor. A farmer, in this case, would say, that the land had got a very bad *tid* ; or, where the season when labouring, and immediately after it, was very favourable, he would call it a good *tid*.

proper circumstances as to *tid*, which infallibly diminishes his crop to an astonishing degree. In this way, I have known several unlucky persons reduced to bankruptcy in farming soils, that undistinguishing observers would call soils of the best quality; because they would sometimes see upon them the most weighty crops they had ever observed. These people do not advert, that though a guinea be a very good thing, the man who is obliged to pay two and twenty shillings for every one of them that he obtains, will very soon be reduced to the necessity of purchasing no more of them.

If a little of that kind of stiff land can be joined as an appendage to a farm of considerable extent of light friable mold, it may become a valuable addition to it; because the operator will thus have employment for his servants and beasts at all times, and when the proper *tid* arrives for labouring his stiff lands, he can turn his whole force upon it, so as to labour it just in the nick of time that is necessary to

insure a superabundant crop. Under these circumstances, such land, in the hands of a skilful farmer, becomes a treasure of great value: but it is only under circumstances similar to this, that the full benefit can ever be derived from such a soil. More need not here be said on the subject of improving lands of this description by means of tillage.

§ III.

On the cultivation of waste lands,

As not connected with a farm.

ALL that has been said above respects the improvement of waste lands when they are connected with an adjoining farm, or in other circumstances where animal dung can be brought upon them from without. If no recourse can be had but to the waste land itself for animal manures, its improvement becomes much more difficult; and other measures for accomplishing it must be adopted.

Temporary measures necessary to be adopted at the beginning of such operations.—If a man were to form a deliberate plan of setting himself down upon an extensive unproductive waste, with a view to cultivate it, he would find himself under very uncomfortable circumstances for some time at the first, whatever were the amount of his funds. Houses must be in the first place erected, and some of the land must be cultivated; but where is he to find food for sustaining the beasts that are necessary for these operations, before his crops come in to furnish that food? This is a very serious consideration, to which he must advert, and which must be obviated before he begins his operations, otherwise he will be subjected to great difficulties, besides accumulated expences and losses, that may prove ruinous. In general, he will find it safest for him, and cheapest, to prevail upon some of the nearest farmers to perform some of these necessary initiatory operations for hire, on such terms as he can engage them;

and keep as few beasts of labour of his own as possible, until he get some crops to sustain them. In this case he must content himself at first with doing not what he could wish, but what he can do; so that he may be obliged to take a crop or two, perhaps, without dunging, after liming only: but from this mode of procedure he should desist the moment he can find abundant subsistence for his working beasts; and begin as soon as possible to put his fields into substantial good order, by dunging those fields that have been limed, and laying them into grass. Whenever he has got abundance of food for his working beasts, his greatest difficulty is overcome; and provided his purse holds out, he may then go on without much difficulty, by adhering to the following plan of procedure.

The natural produce of waste lands consumed by sheep.—There are very few soils so barren but they afford some herbage upon which animals of one sort or other

may be sustained. Sheep are the stock that are best fitted for the most barren soils; and the rearing of sheep, in general, is the use to which such soils are applied in their natural state. A farm of such bare pasture, to be capable of sustaining a flock of sheep so large as to pay for the expence of a skilful shepherd to attend them, without which no sheep can ever thrive, must be of very considerable extent. But whatever be its extent, if the dung of these creatures be properly collected, and judiciously applied, along with lime, aided by a skilful culture and good management, it will furnish the means of gradually meliorating the soil, and rendering it more productive of grass as well as corn, than it ever could have been under that slovenly system of management, which the bars to improvement already enumerated have rendered almost universal.

A slovenly practice being once introduced, it is found that inaccurate ideas come to be spontaneously engrafted upon

it. All mankind know, that if animal dung be laid upon any soil in sufficient quantities, and properly worked into it, the soil will be rendered much more productive than it would have been without it: and if, when it is once brought into that productive state, it be then laid into grass, that patch will continue for an indefinite number of years, much more fertile than the adjacent ground of the very same quality, that has not been dunged.

From this fact, which every person in the country has had an opportunity of observing *, a necessary consequence is, that every soil on which animals of any kind are sustained, must either be in a continual state of progressive melioration, or the effects of the dung of the animals must be lost through some unobserved kind of mismanagement.

* The little gardens made by industrious cottagers, which are to be seen in many places, on very unproductive wastes, afford the most satisfactory examples of the fact here stated.

The dung of these sheep a source of improvement.—To render this proposition palpal-
 ble, suppose a sheep-farm that is capa-
 ble of supporting one thousand sheep. It
 has been ascertained by repeated expe-
 rience, that if the dung of that thousand
 sheep be carefully collected into one mass,
 it will be sufficient to manure one acre
 each day in a very proper manner*: nor
 do I suppose any farmer will not be ready
 to admit, that, if the dung thus produced
 were properly mixed with the soil, and
 the field then immediately laid down
 into grass, without being exhausted by
 corn crops, the grass upon such dung-
 ed fields would be so much augmented in
 quantity, as to be, on an average, upon
 such poor soils, capable of sustaining one
 sheep at least per acre, more than it could
 have done without that dunging.

* This is the general estimate in those counties where
 the sheep-fold has been long used. I myself am inclined
 to think it could not dung so much: On that point I will
 not dispute. The general conclusion will be the same,
 whether it be supposed to be above or below the truth.
 It must vary in different cases.

If this be admitted, it will follow, that as the thousand sheep would afford dung for 365 acres in a year, the melioration of the soil in the course of one year, should be equal to the feed of 365 sheep. So that in the second year, it should, instead of 1000 sheep, be capable of supporting 1365; and, in the third year, an addition of more than 365 might be made to that; and so on, in a progression approaching to a geometrical *ratio*.

That no such melioration as this takes place in practice, is very obvious; on the contrary, it is well known that many wastes can sustain no more beasts at present, than they could have done perhaps a thousand years ago. Hence it follows, that the dung which has been dropped from these animals during the whole of that period, has been dissipated and lost; which, if it had been judiciously managed, might have been the means of a great amelioration during that time.

I do not pretend to say, that it is practicable for any man to collect *all* the dung

of the sheep pastured under any circumstances, so as to apply it in the manner above described, to the immediate amelioration of the soil in the direct manner above specified; and therefore am not so chimerical as to insinuate, that an amelioration, to the above degree, though physically possible, is morally practicable in any case. Under every system of management, some waste must be unavoidably incurred, because some part of the dung must be casually dropped. All I wish to inculcate is, that wherever dung is allowed to be dropped at random on the fields, under the circumstances specified, it either tends not at all to meliorate the soil, or to do it in such a slight degree, as not to be in the least perceptible*: Of course it follows, that the less dung that is suffered to be wasted in this way, the

* For farther particulars respecting the consequences of this kind of inattention, in different circumstances, see the following Essay on the economical consumption of the products of a farm.

better it must be for the general improvement of the country, and the welfare of the community at large ; and that, of course, the neglect of this necessary attention is highly uneconomical ; though it has been so little adverted to, that I make no doubt but nine out of ten who shall read this, will feel themselves disposed to deny the conclusion I draw, though they can neither produce a fact, nor a solid argument to invalidate it. I write however for the information of those who shall have the patience to lend an unprejudiced and attentive ear, and not with a view to obtain the approbation of the inattentive.

The folding of sheep has been practised for many ages, and still is practised in many parts of Britain with much benefit to the owners of flocks, though it has not been any where that I know of attended to, with a view to the steady and progressive amelioration of waste grounds ; for the effecting of which the following

directions may be found of some utility.

Lime should be conjoined with it.—I scruple not again to repeat it, for it cannot be too strongly inculcated, that lime, or other calcareous matter, applied in large quantities, must form the basis of all radical improvements on waste lands. Lime tends to sweeten the grasses produced on every soil to which it has been applied, so as to render them more palatable to all animals; it augments the quantum of the produce considerably; it thus renders the ground capable of sustaining a greater number of beasts. These of course produce more dung, and that dung, if applied in conjunction with the lime, will produce greater and more lasting effects than it could have done without it. It would seem that Heaven, with a view to reward the industry of man, and to set no limits to the possible melioration of the soil, had dispersed this universal fertilizer so generally over our globe, as to

bring it within our reach, by the exertions of human industry, almost every where. Whatever therefore tends to facilitate the acquisition of this manure to any particular place; whether by means of roads, canals, or any other device, must be considered as amongst the most useful of human exertions. Supposing it to be thus attainable, our business here is to show in what manner it can be the most economically applied for the purpose of improving waste grounds.

Folding of sheep, mode of conducting it.—

Where it is proposed to apply the dung of the animals which pasture upon waste lands for the purpose of gradual amelioration, recourse must be had to the fold; and lime should in every possible case be adopted in aid of it. Dung, as well as lime, will always produce the best and quickest returns, when it is connected with tillage; therefore as much of the ground should be fallowed as circumstances will admit, and limed as described in

the preceding parts of this chapter; upon these fallows the sheep should be folded, by means of hurdles, during dry weather; and these hurdles should be so moved, as to admit of the ground being plowed over as soon after the folding as possible. The mold having been previously deepened by the means before described, and the lime applied; it should be turned over by a very ebb [shallow] furrow †. If the soil be proper for turnips, as much of it as has been dunged before the middle of May, should be again plowed over, and instantly sown with turnips the very day it is plowed, as shortly after plowing as possible: for no state of the soil is, in any case, so favourable for the germination of seeds in this country, as that kindly moisture which is always found in new plowed grounds, when in good tilth. This mode of sowing should be universal; as it will more effectually insure a crop from

† *Ebb* differs from *shallow* in this respect. *Ebb* denotes a small depth in a solid body; *shallow* the same of a fluid. Therefore we say an *ebb* furrow, and a *shallow* pool.

missing, than waiting for rain, which frequently bursts the seeds, and consequently loses the crop.

From the middle of May till the middle of August, the turnips should be sown progressively as the ground is dunged, always plowing and sowing it as soon after dunging as possible. After the middle of August, it will be unnecessary to sow any more turnips that season. But if the soil be good, and the dunging abundant, rye, or cole-seed for spring food, or winter tares to succeed them, may be sown till the month of October; after which time, it will seldom be practicable to fold on the fallows.

The turnips, if fed off with sheep, will afford the ground another dunging; and it will then, in general, be so rich as to admit of its being laid down with grass seeds, as above directed, along with the first crop; from which, if it be wanted, one crop of hay may be cut, and then it may be pastured. Thus will a considerable addition be made to the food of ani-

mals upon the farm, and with it an encrease of dung, which, if managed in the same economical manner, will augment the quantity of land that can be annually improved, and thus accelerate the progress of the improvement, till in time the whole must be compleatly gone over in this manner, and rendered in every part much more productive than before. After this, by beginning the same process afresh, in which the addition of lime is not so necessary, the land will be endowed with a yet higher degree of fertility. And thus it may be gone over successively, a second, a third, or a twentieth time, still advancing in its degree of fertility, till it has become as rich as can be desired.

I make no attempt to estimate the quantity of ground that may be thus improved in a given time, or the rapidity with which the progress may be accelerated; because, in a case of this kind, it is obvious that the facts on which these calculations would be grounded, must be

assumed at the pleasure of the writer. It is thus the easiest thing imaginable to make the result be precisely such as he would wish it should be : so that, without his intending it, every such calculation may prove fallacious, and tend greatly to mislead the incautious reader. Besides, it is obvious that no calculation could be made, the result of which, as to the *quantum*, could be relied upon ; because no two cases could be found, under which, by the same mode of management, the result would be the same as to the *quantum* ; for this must depend upon the nature of the soil, and many other indefinite circumstances. All I aim at, by this illustration, is to show that, under the system of management here recommended, there must be a continued progressive amelioration in *every case* ; though the rapidity of that progression, and the proportional expence at which it can be effected, will greatly vary, according to the circumstances of the case.

Neither do I enter into a minute detail of the particulars that would be necessary to be adverted to under this system of management, as my object here is only to illustrate the general principle. Every intelligent farmer, who attends to it, will see that many economical precautions must be adopted, to enable him to derive the full benefit from the dung of his sheep, without hurting the animals themselves. He will see, that if his grounds are of large extent, it will be convenient for him to have at least two folds under the fallow system; one towards one end of his grounds, and the other towards the other. Perhaps it may be necessary to have more folds than two; as his sheep should never be obliged to travel farther to the fold, than it would be necessary for them to travel at any rate to fill their bellies; and when they have filled their bellies, he knows they must lie down to rest themselves, and chew the cud: And this they will do with less disturbance in a fold, at regular periods, than in any other

circumstance. He will also perceive the necessity of having folds provided for them in convenient places, upon dry grafs ground, into which they can be put in rainy weather, when it would hurt his sheep to go upon the fallows. All these, and many other œconomical considerations, the attentive farmer would necessarily discover of himself, and advert to.

I may however observe, that under this system of management, sheep would be much less harassed than they are according to the practice adopted in almost every folding county. Because, when they are folded on the fallows of arable farms, they are always carried off their pastures; and sometimes they must be driven to a considerable distance through narrow lanes, and bad roads, which must tend to harass and exhaust them considerably. None of these evils could be experienced, under the system above recommended; for the folds would gradually advance from the edges towards the middle of the fields, the pastures of which

would surround them on every side. In these circumstances, under the direction of a careful shepherd, sheep could perhaps be made to thrive as well, perhaps better, than under any other system of management.

Permanent inclosures not here necessary.—

The reader will also please to advert, that, under the system of management recommended, no permanent inclosures are necessary; and therefore the total expence of that supposed improvement will be saved to the undertaker. Inclosures, where large flocks of sheep are to be kept, are well known to be not only not necessary, but highly pernicious. Sheep delight in a free open exposure, and a wide range of pasture. Whatever circumscribes them in these respects is hurtful to the animal. All that could be wanted on such lands, would be a ring of moveable hurdles round the fields that are under crop, which could be shifted annually as the improvements went for-

wards ; leaving the grounds, both behind and before, open as at first. Indeed, inclosures are, in many other cases, rather hurtful than the reverse : and such fences as we often see around fields can have no beneficial tendency whatever. They seem only calculated for the purpose of wasting ground, and sacrificing money at the shrine of vanity. I question not, but the money that has been expended on useless inclosures in England, in the original making them and their future support, might, if fairly accumulated, be more than sufficient to pay off the national debt : and it would be no difficult matter to find many fields, where that expence, if it were all fairly to be counted, would be more than the fee-simple of the fields inclosed would amount to.

Divided commons often come under this class of wastes.—The reader will please also to advert, that many of those commons which have been of late divided, are precisely in the circumstances that admit of

being improved, with economy, by no other mode except that which has been above described; but in consequence of each of the proprietors being obliged to *inclose* his own share, it has become totally impracticable *thus to do it*; and, as the expence of inclosing comes to be a considerable item, many of the undertakers become tired of the outlay as soon as that has been affected, and then leave the fields totally neglected; or, if they attempt to plough them up, having no resource for obtaining animal manure, they are forced to lay them out to grafs in that shabby state of poverty, which is the cause of loss to the undertaker, and no advantage to the public.

On the whole, the cultivation of waste lands, where the original soil is of a tolerable quality, though it be at all times a nice operation, and in general attended with considerable difficulties, especially at the beginning, may, for the most part, be accomplished with profit to the undertaker, and much benefit to the commu-

nity, wherever the operator is allowed to reap the *full* profits to be derived from his industry ; but where he is certain that he *can* not, or suspects that he *will* not, be allowed to do this, the very thoughts of attempting it are repressed in his bosom ; and an indolence in this respect, which at first sight appears to be culpable, but which upon a thorough examination will be found highly rational, is the consequence of it. If the effect is expected to cease, the cause must be removed. In all that I have written above, I have endeavoured to inculcate the utility of that kind of cherishing agriculture which aims at nothing short of the highest degree of productiveness ; being conscious, from a long and extensive experience, that where physical obstructions are the only things that are to be surmounted, it is by this practice alone that profit in agriculture is to be expected. In these circumstances, a judicious man will never hesitate at incurring any expence that he knows will add so much to the productiveness of his

fields as barely to repay that expence; but where another person is permitted to come and snatch away his profits, the case is much altered: he then hesitates to lay out one shilling to augment his produce; and not his waste grounds alone are suffered to continue in the state of wastes, but even his cultivated lands, and other inclosures, are suffered to remain for ages in a state of unproductiveness that might be easily removed; and which is therefore highly disgusting to the spirited cultivator to see, and disgraceful to those who, having it in their power, do not exert themselves to remove.

Lime applied to the surface, how to be managed.—I have not given any directions for meliorating ground by means of lime applied to the surface only, without being mixed with the soil; because although I know that lime, or other calcareous matters, applied to the surface of the soil, in *very large quantities*, will have a sensible effect in sweetening the pile, and aug-

menting the quantity of produce also ; yet I likewise know, that the effect of that manure would be so much greater, if mixed with the soil, that it is in very particular situations alone, that it can ever be an economical practice to apply lime on the surface only ; and never, I apprehend, where the soil is of a retentive nature. Where I wished to improve fields that were too steep for admitting the plough, I should advise that the ground, in all cases, where it was in the least of a retentive nature, should be trenched by the spade, before the lime was applied, and then to blend it with the surface-mold. As this operation has to be performed only once, and will not only have a tendency to make the lime produce a more immediate and stronger effect upon the soil, but will also render it, in all future periods, drier in wet weather, and consequently sweeter in the pile ; and moister in dry weather, and consequently less variable in its produce than it otherwise would have been, there can be no doubt

but the expence of trenching will, in a short time, be abundantly repaid.

But where the soil is not retentive, and stones are very abundant, there is not an equal necessity for digging it up; and in these circumstances, lime may be sometimes applied on grass with profit. But, in this case, it will always be adviseable, first to mix the lime with some good mold, if it can be got, in the proportions of nearly two parts of earth for one of lime, and incorporate them well together, by frequent turnings, during the course of several months: for, in this way, it is found that lime, applied on the sward, operates much more powerfully than it ever does when so applied by itself.

Irrigations slightly noticed.—Neither have I said any thing about the practice of irrigation; because it is only in few situations that water in abundance for that purpose, can be commanded. But wherever that can be obtained, it is the surest, and the easiest of all modes of improving

waste grounds. The greatest difficulty that will occur in the management of this manure, for so I will call it, on such soils, is the frequent inequalities that are found upon their surface, so as to prevent the water from being spread evenly over them; or the over retentiveness of the soil. Where these two obstructions are not very great, water, if thrown over the surface in a proper manner, and managed with judgment and discretion, will soon bring the most barren waste into a state of great productiveness, either for grass or corn; and nothing can be better adapted for an alternation of management from the one to the other: nor is there any situation in which water may not be made to operate a great improvement, from the flattest mead to the steepest hill, if the land can be so laid out as to admit of carrying the water thoroughly off from the ground, as soon as circumstances indicate the necessity of so doing. But this circumstance is so very necessary, that in regard to this manure, as well as many others,

the full benefit, in many cases, especially on retentive soils, cannot be obtained till after the mold shall have been loosened to a sufficient depth. After that has been done, and the surface smoothed, and a good sward of grass obtained upon it, the benefits to be derived from the proper use of water will be inconceivably great.

Inclosures, circumstances that render them unnecessary.—Neither have I taken inclosures under consideration ; as I do not consider these to be a *necessary* part of the expence of improving waste grounds ; but rather I conceive that the predeliction in favour of this supposed improvement is, on many occasions, the cause of a great and uneconomical expenditure of valuable funds, which might be more beneficially applied. If ground is to be kept under tillage, inclosures are perhaps, in all cases, (farther than a ring-fence, especially along way sides, or where they operate as drains,) pernicious rather than beneficial. If farther appears, from what has been

faid above, that while land is under graſſes, if the produce be ſcanty, incloſures are always pernicious; and it will be ſhown, in the following Eſſay on the economical conſumption of the practice of a farm, that they are never beneficial where the produce is abundant: ſo that they become of apparent utility only when land is left in graſs, when in a middling ſtate of productiveness only. And this is preciſely the ſtate in which graſs land is the leaſt beneficial to the State: ſo that every effort ſhould be made to induce farmers to avoid leaving their ground in graſs, while it is in this ſhabby condition.

PART SECOND.

On the improvement of waste and barren lands,

By planting Trees.

THOUGH there are few fields which might not admit of being brought into culture, under particular circumstances, there are innumerable tracts of vast extent in this kingdom, which it will be much more profitable to the owner to plant with trees, than to attempt any other mode of improvement. Wherever the soil is dry and infertile ; or where its chief or only produce is heath ; or where it is full of rocks and stones rising to the surface ; or, if it be a stiff obdurate clay, having little surface produce ; and, in general, in most cases where the soil is poor, if not in the very near vicinity of a town, it may be converted into plantations, if it can be freed from hurtful water, with greater profit than any other improvement it could admit of, unless in very particular circumstances ; even

where it may admit of being brought, *in time*, into cultivable ground. Where the surface-produce is naturally small, perhaps nothing could be so economical as, *in the mean while*, to fill it with trees; because these, if judiciously chosen, not only yield a greater profit, than could be drawn from any other kind of produce, and afford conveniences for houses, and other accomodations for inhabitants and for manufactures; but the ground itself, while the trees continue to grow upon it, undergoes, for the most part, a gradual amelioration, which it would not have done in its natural state; and admits of being more easily improved when the proprietor can find leisure to overtake it, than it otherwise would have been.

§ 1.

*General remarks on the different kinds of Trees
that may be planted on Wastes.*

THE kinds of trees that chiefly require our notice on the present occasion, are the oak, ash, elm, beech, birch, chefnut, Scotch fir, spruce ditto, stone-pine, larch and Bermudian cedar. There are many others of lesser note, that may claim our attention on particular occasions.

Of these trees, the oak is best calculated to thrive on the strongest and deepest clays. The ash loves a rich and mellow loam; and where that is the case, it prospers best on rocky banks. The witch elm prefers also a mellow soil, and situations moderately damp, to such as are drier and more arid. The beech thrives remarkably well on dry gravels, and can bear a pretty exposed situation. The birch loves dry mellow soils, and will prosper

well on land that is very sterile. The chestnut delights in deep loam, on a stone shivery bottom, where the roots run no risk of reaching a retentive clay, or other stratum that detains the water. Scots fir, and spruce, will grow well on a light moory earth, if dry, though ever so poor, if cold clay does not rise near to the surface, or gravel or sand. Of the stone-pine, and Bermudian cedar, I have had no experience, and therefore can say nothing. But of all the trees that have been named, the larch prospers on the greatest variety of soils. I have scarcely seen it fail on any soil where water was not permitted to stagnate upon it; but it seems to prefer a mellow loam to either of the extremes of clay or sand. And as this tree is undoubtedly the most useful of the coniferous tribe, as well as the quickest grower, and the most ornamental of that class, it deserves, above all others, the particular attention of the rural improver.

Most of the trees above enumerated, though they will thrive in plantations

when properly made, upon soils of the nature indicated above, require so much care and attention while young, and such a perfect kind of culture until they are fully established, as but little suits the circumstances of owners of waste lands in general. Hence arises the universal complaint of the rapid decrease of live oak in this kingdom ; a circumstance which, though it has been noticed and complained of for a century past, has not admitted of any alleviation ; nor seems likely to do so in the present state of things in this country. Much might be said on this subject, under the idea of patriotic exertions ; seeing it is admitted on all hands, that when the British Oak shall fail, our navy must sustain an irreparable diminution in point of strength and durability : but as nothing that I could say could prove of any avail to incite to enterprises which so many other circumstances tend to counteract, I think it unnecessary to enter upon that subject ; more especially when I consider that it does

not so properly fall under notice, on the present occasion, as the planting of such trees as can, with great economy, be reared in large plantations at a small expence, upon healthy moors and other barren wastes, so as to return an abundant profit to the undertaker in the course of a very moderate period of years.

§ II.

Of Fir Plantations in particular.

THE improvements that have been made in the northern parts of Scotland, by means of large plantations of Scottish fir, upon the barest moors, and in the bleakest and most inhospitable situations, are now well known; and afford the clearest demonstration of the utility of such enterprises, when judiciously conducted: and though it is admitted that the Scotch fir is among the most perishable, and the least valuable kinds of wood that can be reared, and therefore sells every where

at a very moderate price ; yet as the expence of rearing that tree is very trifling, the returns have been in all cases so abundant, as fully to satisfy the persons who have made these plantations ; even when no other circumstances, but the direct income that has arisen from these plantations themselves, has been taken into the account. But when the collateral advantages are likewise adverted to, the improvement occasioned by these appears to be infinitely great. In the neighbourhood of such plantations, houses can be reared at so little expence, and the roofs are so much stronger and better than ordinary, as to induce settlers to make their houses much neater and more commodious than in other places ; rails, and other kinds of dead fences, can be so easily obtained, that poor people are first enabled to have good well fenced gardens, and then commodious inclosures of larger extent ; the branches afford fuel to the settlers, which greatly adds to the comforts of their situation ; cutting and manufacturing the

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wood into various kinds of utensils, furnishes employment to many persons; population is thereby augmented; and, with an increase of population, its necessary consequence follows, a desire for land to produce the necessaries of life, and a consequent increase of rent to the proprietor. Like the settlers in America, these new settlers, in the desert wastes of Scotland, cultivate and improve the soil, as the trees are gradually cleared from it. In this way, Mr George Dempster, who will long be respected in Britain, at this moment sees fields rapidly converting into cultivated ground on his estate, and yielding to him ten or twelve shillings *per* acre rent, not only without any expence to him, but after having derived a considerable profit from the sale of woods of his own planting, which grew upon land that five and twenty years ago was not worth, to him, above two pence *per* acre, and which might have remained in that state perhaps for ages yet to come, had it not been planted at all. It is by a judicious

management of this kind, that men of landed estates, by a little foresight, and with much profit, find themselves enabled to furnish both employment and subsistence to a numerous people, who must otherwise have either remained in a destitute situation, or have abandoned a country which did not properly provide for their accomodation. This is the kind of charity I wish to promote. It is an inexhaustible fund, which enriches the giver, and enobles and adds energy of body and mind to the receiver, instead of debasing it, as the receiving of *alms* in any situation necessarily must do. One would think, that the prospect of being thus extensively useful to mankind, while the interest of one's own family would be so essentially promoted, would prove an irresistible stimulus to every person to enter upon similar enterprises with spirit and alacrity. In Scotland, this spirit is pretty generally excited; and the benefits that result from it are every day becoming more and more apparent. In England,

the hands of industry are, *in this respect also*, tied up. Injudicious fiscal regulations continually oppose every attempt at agricultural improvement; and while our rulers, with the inconsistency of children, talk of giving premiums with one hand for the encouragement of agriculture, they with the other restrain, by an irresistible curb, all attempts at exposing to the eyes of the public those impolitic bars, which have hitherto diminished the productiveness of this island to an astonishing degree; and must continue to diminish it so long as these bars shall be allowed to remain, were premiums to the amount of the whole revenue of Britain to be given for encouraging them. To describe the improvements that *might* be made, is, in these circumstances, a very ungracious task: for no one takes pleasure in representing things as *practicable*, which he knows are not likely to be carried into practice. While a sense of duty induces me to state, with unbiassed candour, the ease with which improvements might be

made, where *physical* obstructions alone are to be surmounted, I find it necessary, at the same time, not to disguise the less obvious, though more powerful obstructions, arising from *moral* causes, that *must* be overcome, before extensive improvements of the nature I have already mentioned, or those I am now about to recommend, can ever be carried into effect.

Price at which a plantation of firs can be made in Scotland.—A plantation of Scotch fir can be made at much less expence than any other kind of tree in the northern parts of Scotland; because the young plants can be afforded at a smaller price than any others. In Aberdeenshire, where planting is so general as to have become a sort of occupation, fir plants of two years old, (and above that age, no experienced planter will ever buy them,) sometimes sell at the very low rate of four-pence *per* 1000, consisting of 12 hundred; and they seldom exceed eight-pence; on an average, six-pence, or one half-penny *per* hun-

dred : and there are men who make a business of making plantations, who will undertake to compleat the whole inclosing and planting, at the distance of one yard from each other, and uphold them for five years, that is, supply any deficiencies that may be observed, at the rate of from ten to thirty shillings *per* Scotch acre, (four Scotch are equal to five English acres nearly,) according to the size of the inclosure, and the nature of the fence. In all cases of this kind, it is supposed the plantations are of 30 or 40 acres, or upwards : for where the inclosures are smaller, the expence of inclosing is proportionally augmented. The charge is thus not only made moderate, but the total expence a man is to incur can be ascertained before he begins, which prevents him from being involved in unforeseen difficulties.

On bleak exposures, which kinds thrive best.

—It is found by experience, that there is scarcely any soil so bad, or any exposure

so bleak, where this tree will not live, if the plantation be of sufficient extent, and not upon the very summit of high peaked hills. They do not, indeed, bear the sea-air very well, where they are much exposed to the severity of its blasts; nor is the wood ever of a good quality, or the tree long lived, upon clayey soils. Several persons in the south of England have found, that the pine-after bears the sea blast much better than any others of the fir tribe; which is a discovery of great importance, and will no doubt be attended to by improvers. The spruce-fir, however, will bear a still more exposed situation than the Scotch fir; and, after a few years from the time of planting, it shoots up with still greater luxuriance. But the cones not being to be had in equal abundance, and the plants being more difficult to rear, they are sold at a much higher price, usually about six shillings *per* thousand, fit for planting out. Silver fir, in a good soil, prospers well, and is a beautiful tree, on account of the depth of its

shade; but the price of the plants is too great to admit of large plantations of them being made.

Firs ought to be planted out while very young.

—Wherever the situation is bleak, and much exposed to strong blasts of wind, the plantation must not only be of considerable extent, if you expect the trees to thrive, but the trees must be planted very close together, so that each plant stands at the distance of from two to three feet at most from each other; the more exposed the situation the closer they must be; for it is observed that until the branches intermingle and thus serve to give a mutual support to each other, the trees never begin to advance with vigour. Where the plantations are thus thick, there is a necessity for beginning to thin these out at a pretty early period; so that after the tenth to the fifteenth year from the time of planting, men must be constantly employed in thinning these plantations; and there are very few situations, indeed, in

which these thinnings will not sell for such a price as to do much more, than pay for the expence of cutting them out : but where the plantations are extensive, these thinnings sell at a small price ; which affords the conveniencies to settlers in that neighbourhood I formerly remarked, and gives employment to a multitude of persons to dress and carry them to more distant markets.

The leaves and branches of the fir-tree a wholesome food for cattle and sheep.—One advantage attending the culture of the fir tree, is, that it has been found, by some well authenticated experiments, that the leaves and young branches of the Scotch fir afford a very wholesome nourishment to cattle and to sheep ; so that they may be applied, in cases of necessity, to the sustaining of those useful animals. In hill countries, that are stocked with either sheep or cattle, the benefits that may be derived occasionally from them in this northern climate, where snow some-

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times lies for many weeks together, so as to prevent the beasts from having access to other food, will be very great; and therefore no person should be without a plantation of firs on every farm for this very purpose, were it to be of no other use whatever. It may happen that, for many years together, there may be no necessity of having recourse to this aid; in which case the trees may be permitted to grow without molestation. When this supply must be resorted to, it is only necessary to cut down some of the branches with leaves upon them every day, and give them to the beasts, fresh and fresh as they are wanted; on which food the creatures may be preserved in perfect health for months together, should it be necessary. The larger branches left by them being piled up in a heap to dry, become excellent firewood; and the trees prosper as well as they could do in any other circumstances, and afford an easy insurance to the farmer against the heavy losses he is so often, without this aid, obliged to

experience. I do not know an improvement in agriculture that is greater than this one, or that can be afforded with so little trouble or expence. Nothing can stand in the way of its being universally adopted, unless it be the difficulty of reconciling the interest of the tenant and the proprietor. As the law at present stands, the expence of making the plantation must fall upon the proprietor, seeing he is the sole owner of the wood; and the tenant ought to have permission to lop the branches occasionally, and be bound to preserve the plantation. It seems to be by no means impossible to reconcile these interests; but this would require an exertion on both sides, which, in the present state of our knowledge, in regard to things of this sort, can scarcely, I am afraid, be expected.

§ III.

Of the Larch Tree, its value and uses.

BUT the larch is so much more valuable than the Scotch fir, on all other accounts, that it is now universally preferred to it for plantations of large extent, in almost every situation. The qualities of this tree are, indeed, so numerous and so excellent, that these require only to be known, in order to make it be propagated to a greater extent than any other tree whatever, that can be reared in this climate. I dare hardly even venture to mention these qualities, on the present occasion, lest I shall be accused of exaggeration; though the proofs that ascertain them are so strong as to be irresistible. As this tree has only been of late introduced into Britain, the qualities of its wood are not here as yet sufficiently understood; and it has been hitherto cultivated chiefly rather as

an ornamental tree, than with a view to profit: for, wherever it has been introduced, it grows so freely, on almost every soil or situation; it is so healthy, and so beautiful when in leaf; is so highly ornamental, when covered with its abundant pink blossoms in the spring; and is so elegant in its form, that it becomes instantly a favourite with every one who has begun to plant it.

The value of its wood remarked by Vitruvius.—The larch (*Pinus Larix* Lin:) is a native of the southern parts of Europe, and there the valuable qualities of its timber have been long known. Among the Romans it was employed, in preference to every other kind of wood in building, for all purposes where strength and durability were required; and Vitruvius attributes the sudden decay of buildings erected in his time, when compared with the superior durability of more ancient structures, in a great measure to the want of larix-wood in the neighbourhood.

of Rome; that kind of wood having been there exhausted before his time, and the expence of bringing it from a distance had become so high, as greatly to circumscribe the use of it. This tree is found in great abundance every where along the whole extent of that vast range of mountains called the Alps, and on those lesser hills that branch off from these. In all places there, where the situation prevents the young plants from being choaked by grafs, or cropped by animals while young, it springs up from self sown seeds; and as it grows naturally streight, it presented itself to the distressed inhabitants round the borders of the Adriatic gulf, as the fittest material for piles to be driven into the mud, on which their houses might be reared, when they were forced to seek for refuge, in the inaccessible marches where Venice now stands, from the barbarous tribes who over-ran Italy in the middle ages. Immense numbers of these trees have been then felled and applied to this purpose; and thus has been afford-

ed an opportunity for proving, by a fair experiment, the incomparable durability of that timber. For it has been found, by experience, when these buildings have occasion to be renewed, that after having stood many hundreds of years, these piles are not only uncorrupted, but have by time acquired, in this situation, a degree of hardness they did not originally possess: so that there is every appearance that, in this particular situation, the wood may be deemed incorruptible.

Its extreme durability remarked by Doctor Pallas.—In other situations, it has been found to possess a durability nearly equal with the above. When Doctor Pallas, under the auspices of the Empress of all the Russias, was employed, a good many years ago, to make a survey of the eastern parts of her Asiatic dominions, he observed, in the peninsula of Kamtschatka, several *tumuli* that were evidently artificial; but these had been reared up at a period so remote,

that none of the present inhabitants of that country had any tradition even respecting their origin, or the uses for which they had been originally constructed. To obtain a knowledge of this, he caused one of them to be opened up. In the centre of the mound, and on a level with the surface of the plain on which it stood, he found an oblong platform, protected by beams of wood joining each other at the top, and spreading wide below, like the roof of a house, and placed close together so as to prevent the earth from falling on the area ; where had been deposited some human bodies stretched at full length, as appeared by the remains of skeletons there found. This kind of roof had been covered over with earth to a great height ; and thus had been formed the *tumuli* in question. The wood was larch : and here also it was found to be uncorrupted. How long it had remained there it is impossible to say ; but from concomitant circumstances, it is probable it could not be less than several thousand years.

In both these instances, however, the wood was preserved from the air, and afford no fair proof of its durability in other situations. But there are not wanting proofs sufficient of its extreme durability for the purposes of common life, even in modern times, independent of facts that are on record concerning that circumstance in antient authors.

By Mr Harte, and Admiral Greig.—The Reverend Mr Harte, in his *Essays on agriculture*, a most valuable performance, that is but too little known, enlarges on the economical uses of larch wood with great satisfaction. Among other particulars, he describes the manner in which the huts of the peasants in Carniola are constructed of it, with a kind of exultation that was natural to a good mind when it develops a beneficent contrivance, that tended so much to render the lot of the lower classes of mankind much more comfortable than could be effected by

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any other means that had hitherto occurred to him.

These cottages are constructed entirely of larch wood *: A squared beam is first laid flat on the ground where the wall is intended to be reared ; into that, by means of tenons cut out for that purpose, are fixed uprights, consisting of squared logs of the same, cut to the height of the intended wall, so close as to touch each other. A beam running parallel to the first receives their tops, and keeps them firm in their upright position. These are connected with the cross walls, which rise upwards in the proper form of a gabel. A roof is erected on these beams, in which, over the couples, are laid cingles of larch wood ; and the hut is then finished to continue for ages. In erecting the walls, openings are left for doors and windows : and in the roof, places are made for the emission of smoke. When newly erected, the roof and all parts of the structure

* I here quote from recollection only, not having the book at hand.

are white ; but after a short time, there oozes out from the pores of the wood a kind of juice that fills up every crannie, so as to cement the whole into one connected mass, without chinks of any kind, so as to become quite impervious either to wind or rain. This juice gradually hardens, and being of a dark colour, the building is covered all over as if with a varnish, that is not affected by any vicissitudes of weather. As soon as this varnish appears, the peasant's care respecting his little habitation is at an end for ever. How long such a structure may last, without standing in need of any repairs, has not been ascertained ; but if the work has been properly executed, and duly secured against the effects of wind and external injuries, it is much beyond the extent of the utmost period of human life. Were poor people, who in this country are secured from oppression in every respect, to have it in their power to have their cabbins rendered thus secure against the injuries of weather, and the ravages

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of fire, (for this wood so powerfully resists fire, that a flaming brand laid upon the roof, and suffered to burn till it were consumed, would not affect it) what a valuable addition it would make to the sum-total of human happiness! The late Admiral Greig, who had seen many such huts in Siberia, was earnest with the gentlemen in Scotland, when he made his last visit to his native country, to induce them to make extensive plantations of larch wood, insisting chiefly on this circumstance, and asserting that he had seen many huts, which had been thus constructed, and which he was assured had stood more than *an hundred* years, without standing in need of the smallest repairs.

By M. Le President de la Tour d'Aigues.—Of the durability of this wood the following facts are additional proofs: “I
“ have in my garden, (says M. le President
“ de la Tour d'Aigues,) in the year 1787,
“ some rails, part of which are oak, and
“ part of them *larch wood*. The rails were

" made in the year 1743, and only once
 " painted. *The oak has yielded to time, but*
 " *the larch is still sound.* They employ this
 " wood at present in *Provence* for making
 " casks. The chesnut of the Cevennes
 " had supplied the place of the oak, and
 " the larch now successfully supplies that
 " of the chesnut. The fineness of the
 " grain retains perfectly the spirit of the
 " liquor, and does not alter its qualities.
 " It has been employed for that use for
 " time immemorial in the higher Daup-
 " hinè, from *Sisteron* even to *Briançon*. I
 " have in my castle of *Tour d'Aigues* beams
 " of twenty inches square, which are
 " found, though upwards of *two hundred*
 " *years old*; but trees of this size are on-
 " ly now to be found in places whence
 " they cannot be transported. There are
 " in some places of Dauphinè, and in the
 " forests of *Baye* in *Provence*, larch trees,
 " which two men could not grasp, and
 " more than twelve toches (about 72
 " feet) in height *."

* Memoirs of the Royal Society of Agriculture, Paris.
 1787.

By a gentleman from Switzerland.—This wood has been remarked for the same indestructible quality wherever it has been employed in work. I myself happened to fall into company with a native of Switzerland, in the month of October last, [1794] in the house of the ingenious Doctor Percival of Manchester. The conversation happening to turn upon this subject, the Doctor asked that gentleman, if larch wood was much used in Switzerland? His answer was, “very much.” “For what purposes is it chiefly employed?” “For every use, where strength or durability are required.” He added, that a short while before he came to Britain, he had been on a visit to an acquaintance in the country, who lived in a *chateau* that was known to be above two hundred years old, the very stones of which it was built being now mouldering to decay; and he remarked that the windows, by their fashion and workmanship, were judged to be the original windows that had been put into the

house, and did not discover the smallest marks of decay. These windows were made of larch wood. He added, that the consumption of this wood in Switzerland, on account of its many valuable qualities, has been so great, as to exceed the quantity naturally produced: so that it has become scarce and dear; which has induced many gentlemen in that country to make large plantations of it of late, with a view to the profit that may be derived from it,

By Mr Ritchie, British Consul at Venice.—Mr Ritchie, the British *charge des affaires*, at Venice, writes thus to Mr Moore, secretary to the Society of Arts in the Strand, London, in answer to some queries respecting the uses that are made of larch-wood in Venice. “It resists, (says he,) the
 “intemperature of the air more than any
 “other wood known in this country, and
 “therefore it is much used in outer gates,
 “pales, &c. which are constantly exposed
 “to the open air. It is no less durable
 “within doors: and in some of the

“ old palaces here, there are beams of
 “ larix as found as when first placed there.
 “ In a word, *Wherever strength and durabili-*
 “ *ty are required, this is reckoned here the*
 “ *most choice and valuable wood*, and it may
 “ be applied to a great number of uses.”

Among these uses, he particularly specifies *ship-building*, for which use they deem it the most valuable they have; but, on account of the superior *levity* of fir wood, they in some cases prefer it in those seas, where the shallowness of the waters renders buoyancy a quality much prized. Transact. of the Soc. of Arts, Vol. I.

In Russia, also, their ships of war are built of larch wood, which is brought for that purpose, at a great expence, from the interior parts of Siberia to Archangel, for the royal dock-yards only. And that it was employed in old times, seems to be proved by the following singular fact recorded by Mr Evelyn in his *Sylva*, article *Larix*.

By Mr Evelyn.—“ Witson, (says he)
 “ a Dutch writer on ship-building, says,
 “ that a vessel, constructed of this wood
 “ and cypress, was lately (when did
 “ Witson write?) found in the Numidian
 “ sea, twelve fathoms under water. It
 “ was reduced to such a degree of hard-
 “ ness as greatly to resist the sharpest tool.
 “ Nor did it appear that any part of it
 “ had perished, although it had conti-
 “ nued under water above a thousand
 “ and four hundred years.”

Mr Evelyn farther remarks that it seems to excell for beams, doors, windows, and masts of ships, and *resists the worm*. When driven into the ground, it becomes in time almost petrified, and is capable of supporting an incredible weight. It makes, he says, everlasting spouts, pent houses, and featheredge, which need neither pitch nor painting to preserve them; also excellent pails, posts, rails and props for vines. The texture of the wood is close, and admits of a fine polish, so as to

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make beautiful finishing to rooms. It is neither liable to shrink nor warp, when put up into work; and when cut into thin slices, it is the very best substance yet known for putting behind prints in framing. On account of these qualities it is excellent for making pallets for painters to mix their colours upon. Before the use of canvas, it formed the tables on which the great Raphael, and the famous artists of his time, eternised their art; and, on account of the fine polish it takes, has been supposed to give to their colours a peculiar grace and brilliancy. However that may be, it is certain that the modern Italians make use of this wood for picture-frames, because no other wood gives gildings such force, brightness, and as it were a sort of natural burnish; and this, he thinks, is the grand secret why Italian gilding on wood is so much better than ours, which has often a tarnished spongy cast, and looks like gilt ginger-bread. Among other qualities of this wood, Mr Evelyn remarks that it resists

the worm; and that it does resist the worm in houses, is perfectly proved by the single fact that the paintings which have been done upon it for many hundred years, are still entire; but I have met with no fact that proves that it will resist the sea worm; though there is no instance on record that I have met with, in which it has been penetrated by that destructive creature.

Mr Evelyn, for these and other properties that he found recorded concerning this wood, warmly recommended the culture of the larch tree to his countrymen: But the minds of men were not yet prepared to adopt this improvement, and he preached to them in vain. More than a hundred years elapsed after his death, before, perhaps, one person in the island was daring enough even to try if it would live here: what he in vain recommended we have seen in some measure effected. It is now known to thrive every where; but our descendants only

can see the wood in perfection of the produce of this island.

In all the foregoing instances, the experiments, we may suppose, respect that wood when it has attained full maturity, and is in the highest state of perfection it can be made to attain. But it is well known that any kind of fir-wood that has grown very quickly, and is as yet young, though it should have attained a considerable size, consists chiefly of a kind of imperfect timber, of the nature of that imperfect kind of wood which is in general found in a ring of more or less thickness round the tree, immediately under the bark, which has been commonly called *blae*, because of its pale and sickly colour, to distinguish it from the harder and better ripened wood nearer the heart; which, especially in old trees, is of a redder colour, and is therefore called *red wood*. It is now well known that the best fir timber which comes from Riga, and other places on the Baltic, is the produce of the same tree that is commonly cultiva-

ted here under the name of the *Scotch fir* ; but having grown more slowly in these countries than the *planted* trees do here for the most part, and having been allowed to attain a much greater age, that wood is beyond comparison closer, and four times at least more durable, in any kind of work, than the young raw deals which are made from wood the usual growth of this country. The same circumstances attend the growth, and, we have reason to believe, the other qualities of larch timber : The larch is thus described by an acquaintance of mine who crossed the Alps in October 1793 : “ I saw, said he, larch, or larix, cut down “ about thirty miles south of Bolzano, at “ an elevation of more than two miles “ perpendicular height above the valley “ and river Adige, some of which were “ near three feet diameter, and all *red* “ wood, the effect of age, except a ring of “ less than an inch on the outside. The “ timber remarkably fine, hard and “ strong. The larch is now generally

“ planted all over Britain. If it is left
 “ to grow to a sufficient age, the owners
 “ will not be disappointed.” We have
 not however yet had an opportunity of
 seeing any of that *aged* larch wood in
 Scotland ; for its introduction into this
 country was at a period so late as not to
 admit of it. The two first trees of that
 wood which were planted in Britain, by
 the best account I can find, are at Dun-
 keld in Perthshire, the seat of the Duke
 of Athole, in a most thriving condition,
 and are not likely to be permitted to be
 cut down soon. They are known to be
 now exactly 53 years of age. Two years
 ago, they measured as under ; as com-
 municated to me by Mr Scougal, then
 gardener to the Duke of Athole.

“ The larch trees are fifty years old ;
 “ they are 120 feet high, three feet and
 “ a half diameter, one yard above the
 “ ground ; and are said to contain 110
 “ cubic feet of wood each in the trunk,
 “ exclusive of branches.” A surprising
 growth ! This is at the rate of $2\frac{1}{4}$ cubic

feet nearly each year, which, valuing it only at one shilling *per* foot, would be 25-3d. exclusive of branches*.

* In order to ascertain this fact with more precision, I applied to the Duke of Athole's present gardener; in answer to which I received the following letter.

" SIR,

DUNKELD, *March* 28. 1796.

The gardener here has delivered to me your letter of the 26th current, in consequence of which an exact measurement has been made of the largest larch tree on the Duke of Athole's lawn at Dunkeld. And the following are its dimensions :

F. In.				F. In.			
At the height of 1 8 from the ground, cir-				cumference is - 11 11			
—	—	3	•	—	—	—	10 0 5
—	—	6	o	—	—	—	9 0
—	—	9	o	—	—	—	8 6
—	—	12	o	—	—	—	8 2
—	—	18	o	—	—	—	7 11
—	—	24	o	—	—	—	7 7

"The above is from actual measurement: The following is computed

	F.	In.		F.	In.
At the height of	48	0	from the ground, cir-		
			cumference may be	6	0
— — —	70	0	— — —	3	0
from whence it tapers to a top about	15	feet :	So the whole		
height is	85	feet,	planted in spring	1741.	There are sev-

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Even young larch wood particularly durable.—The following facts, which respect

veral larix upwards of 100 feet in height, which are 5 or 6 years younger, but none of so great girth.

“ Of late years, the Duke of Athole has, to make trial of the wood, applied larch to a variety of purposes; such as mill-axes, flooring in houses, window-frames, and doors, post, and rail, and boat-building; for all of which it has hitherto appeared to answer so well, that it is certainly the greatest acquisition of wood ever introduced into Great Britain; the more especially as it not only grows, but attains a considerable size in situations where, from the elevation of the ground, and bleak exposure, Scotch firs either die, or become stunted. Fishing boats made of larch under forty years old, last nearly three times as long as those built of Norway fir. The Duke is so persuaded of the excellence of the wood, that his plantations, on high grounds particularly, have of late years been almost entirely composed of that wood. Those plantations though large, generally exceeding 100,000 every year, would have been more extensive, if the trees were not obliged to be pitted in planting them, the trees having attained some size; viz. from 20 inches to 3 feet, by being two years and sometimes longer transplanted from the seed-beds into others, before put out to stand, in order to prevent their being choaked by the undergrowth of broom and whins, which rise very rapidly in the neighbourhood of Dunkeld: but where there are not these disadvantages, it is imagined they might be planted with success from the seed-bed, in the same way as Scotch firs: an experiment

raw grown wood in this country, tend to prove, in the most satisfactory manner, that, *even in that state*, larch wood possesses qualities of the most valuable kind, that would be deemed fabulous, were they not well authenticated.

In January 1772, a violent wind, which committed great devastations in Scotland, overturned, among others, two or three larch trees that grew in the plantations of Mr Campbell of Shawfield, at Woodhall, near Glasgow. These trees were so large

which is to be tried : The only draw-back to that will be, that both wild and tame animals, which may break into the plantations, would be apt to browse on the top-shoots of larch, a tree they are particularly fond of ; but, if that is not very often repeated, the larch will still push forward on a new leader, and rise.

"The late violent winds blew over a larix, in the Duke's lawn, of 50 years age, 86 feet 6 inches in height, containing 82 feet of solid wood ; for which 4l. Sterling was offered as it lay on the ground. I am, Sir, your obedient servant. (Signed) GEORGE FARQUHAR."

I have found by experience, that pitting, as mentioned above, is not necessary, unless where grass or other weeds grow with such luxuriance as to endanger smothering the young plants.

as to admit of being cut up into planks, which were not particularly attended to by the late Mr Campbell, who was then alive. About ten years afterwards, his brother, the present very respectable owner, succeeded to that estate; and finding, in his rounds, a low house made of boards which had been employed for feeding swine, in a waste corner, under the drip of some large trees, that had been neglected for many years, which he thought a very unsightly object; ordered it to be taken down and carried away as rubbish. The carpenter, when he began to knock it to pieces, was extremely surprised to find the wood quite fresh, and mentioned it to Mr Campbell, as a very unusual circumstance; telling him, at the same time, that he now recognised that these troughs had been made of the larch wood above named. Some time afterwards, being ordered to repair the top of some stalls in the stable, that had been gnawed by the horses, on that occasion, the carpenter said he did not know how he could then do

it, as he happened to have no seasoned wood at the time, and could get none in that neighbourhood. Mr Campbell, recollecting that he had said the wood of the swine-house was quite fresh, desired him to examine it, and see if that could be made to answer the purpose. It was tried, and found to be perfectly good; and having been put up, stood there, without any marks of decay, for several years, till, in consequence of some considerable alterations that were making, the whole of these stalls were taken away, and these pieces of larch wood lost sight of.

The same gentleman having afterwards learnt, that on the coast of Lincolnshire, where decoys for catching wild ducks are made, in doing which, it becomes necessary to drive many stakes into the mud overflowed by the sea, for the purpose of stretching the nets, (which stakes are found to be very expensive to uphold, as oak stakes, between low and high water-mark, very soon decay,)—one gentleman, wishing to try the durability of larch wood in these

circumstances, put alternate stakes of larch and oak. Two sets of oak wood had been entirely worn out, as his informant assured him, and the larch continued firm. How long they may still last, it is impossible to say.

Mr Campbell, desirous of making a comparative trial himself, made two gates, the supporters of which were to be of timber; one of the posts in each gate he caused to be made of larch wood; and the other, of the same size and shape, of the best foreign fir he could find. They were both painted, for the sake of neatness and uniformity. One set of the fir stakes were worn out some time ago, and have been renewed. The larch stands firm till this hour; and how many sets of fir posts they may outlast, no one can tell.

I myself happened to observe a spire of young larch wood, in the garden of Mr Dempster, who has been so long distinguished for his conduct in the British Parliament, which had been stuck into the

ground as a pole for a plant of hops, and allowed to stand there summer and winter, for the space, as he found, upon enquiry, of more than six years : on a careful examination of it, no symptom whatever of rotting could be discovered in it any where.

This, and other facts, having turned my attention to the subject of larch wood very strongly, I caused some spires to be cut out from a plantation I had made of larch in Aberdeenshire, and sent to this place for the sake of experiment. These spires were of no more than eight years growth, at the time they were cut, and were upwards of twenty feet high : of some of these I caused a rude seat to be made for a garden, the joinings being made merely by boring holes with an auger into the parts that were to receive the ends of other pieces, which were shaped so as to fit the holes. The bark was not taken off ; and some of the smallest pieces in the top, not thicker than my finger, were thus placed as uprights in the back.

It is five years since the wood was cut, and four years since the seat was made, which has stood since that time in a place where it is exposed to the sun and weather, with only the partial shelter of a few branches of a tree over head. No marks of rotting are as yet (January 10th 1796) discoverable on any part of it, nor of the other spires, which have lain without doors all that time, in various circumstances; but what appears still more extraordinary to me, is, that it has neither gelled (split by the action of the sun,) nor shrunk so as to loosen the joints, which still continue firm.

I beg leave, however, to observe, that though I cannot discover the smallest symptoms of rotting on any part of these spires; yet, upon a very accurate examination, *it appears to me* that the wood is rather of less specific gravity than it was at first, which I doubt not proceeds from an imperceptible kind of decay, which I suppose will in time render it, as we call it, *daezed*, that is, less strong than it ori-

ginally was, though not apparently rotten * : but how long it may be before that period shall arrive, so as to render it brittle, I cannot tell. It doubtless is not yet arrived, even with regard to the smallest pieces of no more than one year's growth, which are still firm and tough to an astonishing degree, considering the raw and unsubstantial nature of the half formed wood of these tender twigs.

In addition to these facts, and to show that every twig of this tree may be employed for some useful purpose, I shall just add, that George Newnham, Esq; of Summerhill, near Corke, informed me, *anno* 1793, that he employed some *branches* of larch wood as stakes for espalier trees in his garden, some years ago, intermixed with stakes of various other sorts ; all which larch stakes remained firm after the

* Even this, however, is not a *certainty* ; perhaps I may be mistaken in thinking it lighter than the *dried* wood, while yet fresh cut down : for I could not compare them accurately together at the same time, and did not think of *weighing* the same pieces at different periods.

others began to decay. In a subsequent letter, dated November 10th 1794, he says, " The stakes of larch wood still remain in my garden perfectly sound, both above and below ground; the moisture seems to harden the wood in a surprising manner; the stakes of the other timber are in general quite decayed."

These facts establish, beyond a possibility of doubt, the incomparable durability of this wood, even in *the early* periods of its growth; a circumstance which is of too much importance to the landed and agricultural interest of this country, to require any apology in me for endeavouring to establish, beyond a possibility of doubt, at the expence of a few additional pages of writing.

Larch wood neither shrinks nor warps, nor is eaten by worms.—Nor is durability alone its only quality. When made into plank, there are proofs equally incontestible that it possesses the additional excellency of

neither *shrinking* nor *warping*, when made into work, nor of being liable to be attacked by the worm, during the course of several ages. The single fact already quoted from Evelyn, that Raphael, Urban, &c. painted many of their best pictures on larch wood, which exist till this day sound and entire, establishes these things beyond a doubt. Most of these pictures are now upwards of three hundred years old : It is obvious that the smallest warping, or shrinking in the wood, must have cracked and destroyed the paintings : nor are any worm holes discovered on examining the back of the boards.

Whether this wood is capable of resisting the sea worm, I have not been able to ascertain by actual experiment. The entire state of the vessel found in the Numidian sea, and many other circumstances, concur to render this probable. But a fact of this importance ought not to be left on the footing of *probability* only. I have been for two years past in diligent quest of two things which I have

not been able to find : the *first* is, a piece of larch wood actually in a state of rottenness, no matter by what means it has been produced ; but none of my correspondents have been able to help me to it : The *second* is, a piece of sound, well ripened larch wood, in a state of perfection, for the purpose of trying fairly whether it be capable of resisting the sea worm or not. It is well known that at the bridge of Rochester near Chatham, every other kind of wood that is sunk but for a very short time into the waters of the river Medway, is very soon perforated by the sea-worm : My intention was, if I could have found the larch wood, to cause it to be fastened, by means of cross bars, to a logg of sound oak wood, of the same dimensions, and both of them to be sunk in the river at the same time. Let them be taken up, after lying some months, and examined : they may be then returned again into the water or not, as circumstances seem to indicate. Thus would a fair comparative trial be made, the re-

sult of which, in all its circumstances, ought to be communicated to the public. I reject raw and imperfect wood from this experiment, for very obvious reasons.

Larch wood nearly incombustible.—To all these valuable qualities, justice still compels me to add, that larch wood may be said to be in some measure *incombustible*. In consequence of its inaptitude to take fire, Mr Harte observes, that there is perhaps no instance of the cabbins of the Carnioleans being set on fire, though they are careless about throwing even flaming firebrands upon their roofs. The fact is, that though larch wood may be consumed by fire, yet, where the masses are large, even if a fire were placed upon the bare wood, though it might be slowly corroded by it, and, in time, might thus have a hole eat into it; yet, unless in particular circumstances, it could not be made to flame, so as to communicate it to other bodies. This quality of larch wood was known in the days of Julius Cæsar, who

calls it *lignum igni impenetrabile*. So great is its inaptitude to burn, that a philosopher in Italy thought he had made a great discovery, during the last century, and actually published a book, for the express purpose of convincing his countrymen, that it was *possible* to employ larch wood, on certain occasions, for the purpose of incineration: but his experiments went no farther than to show, that it was possible to make billets of that wood, when not of a very large size, actually flame: but to make it burn well, a blast furnace is absolutely necessary. By this means, his treatise proves, in the clearest manner, the general proposition announced above; viz. that larch wood, in ordinary circumstances, may be said to be unflammable. That it may be consumed in a *blast furnace* has, however, been long known; and the charcoal made of this wood, when thus employed, is deemed much more valuable than any other, for the purpose of smelting iron: probably it admits of being made to produce a more intense

degree of heat. I shall have occasion to show below, that my countrymen have discovered a way by which this quality of the tree renders it peculiarly valuable as a fire wood.

Larch, the Shittim wood of Scripture.—On this head, it is worth while to remark, that an ingenious French critic contends, that the table of *shittim* wood, which was kept in the Jewish ark for sacrifices, must have been made of larch, as no other kind of wood is known to possess the same incombustible quality. The cedar of Lebanon, which was so much praised in antiquity for its many valuable qualities, is well known to be very nearly allied to the *larix* in many of its characteristics, both in botany and economics.

The Larch is of very quick growth.—Having thus proved, beyond a doubt, that the *larix*, on account of the very valuable qualities of the wood, deserves to be cultivated in every part of this country ;

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I shall next proceed to show, that, on account of its quickness of growth, and the variety of soils and exposures on which it may be made to thrive, (its beauty is universally admitted,) it deserves to be extensively cultivated in every part of this country, as one of the most *profitable*, as well as the most useful productions that can be reared in these northern regions.

As to its quickness of growth, the following facts will prove satisfactory.

Mr Newnham, before quoted, sends me the measurement of eight trees in a small plantation of his, in the spring and autumn of the year 1794, which were as in the following table:

No.	Height.		Height.		Increase.
	F.	In.	F.	In.	
1 in March last	6	0	in Nov.	10 0	4 0
2 —	5	9	—	10 0	4 3
3 —	5	2	—	9 0	3 10
4 —	4	6	—	7 6	3 0
5 —	5	7	—	9 10	4 3
6 —	5	1	—	9 2	4 1
7 —	4	3	—	7 10½	3 7½
8 —	6	3	—	10 5	4 2
Average	5	4	nearly	9 2¾	3 9¼ nearly

N. B. No. 1. encreased in circumference 3 inches, measured 2 feet from the ground.

No. 6th, Not quite 2 inches.

But as it may be suspected that these are only a few of the best, I beg leave to add, that in the plantation from which my spires were cut, the trees, at *eight* years growth, measured, over the whole plantation, above 20 feet in height on an average, the trees were from six to nine inches high when planted. They now, being 12 years old, measure, on an average, about from 34 to 36 feet in height. This plantation was made on a very good soil, and favourably situated. The particulars of the culture, to which I must attribute their quick growth in some degree, will be afterwards specified.

Nor is it only while the tree is young that it makes these vigorous shoots; for it appears, by the measurement of the trees in Dunkeld, that this in a great measure continues even till a period of age beyond that which they have as yet at-

tained : For 120 feet, in 50 years, gives an average of nearly 2 feet and a half in height for each year of their growth. What a pleasing thing it is for a man to have a certainty of seeing such fine trees of his own planting, if he begins while in the vigour of life, and attains to only a moderate age ! What a short time to look back is twelve years !—Look at a plantation, of feet in height, what a beautiful object it is ! Such are the allurements in point of pleasure only. Let us now turn our views to profit, which ought to be the chief object in every extensive operation in rural affairs.

The greatest obstruction to the planting of trees is the prospect that a long period must elapse before any emolument can be derived from these plantations. This operates as a strong bar to exertions of this sort : for a few years, to look forward, appears a long period : but when it is past, it seems but as yesterday ; and it is then we regret the advantages we might have enjoyed, had we not let slip

the golden opportunity which we so carelessly neglected to improve, while in our power. Let him who reads this not dwell upon the past: To him it is gone for ever and cannot be recalled. But let him remember that time now is. Let the present moment then be improved: for, if he does not, he will have the same mortifying reflections to make a few years hence. There is scarcely one man alive who is so old as to need to despair of drawing profit, even in his own lifetime, from the plantations he may now make; and he is certain that if death does not overtake him directly, his mind will be soothed with the pleasing prospects of being benefitted by his labours, and the certainty of deriving pleasure from their thriving condition in the mean while.

It is a singular felicity, in making a plantation of larches, that the wood can be applied to a variety of useful purposes *while it is yet of a very small size*; and that, independent of the profit it will thus

immediately bring, an extensive plantation of that wood will, in a very short time, furnish employment to a great number of persons in manufacturing the various articles that can be made of it; who will thus contribute to his pleasure and emolument in a thousand ways that cannot be enumerated. For whatever calls forth the exertions of human industry, and furnishes the means of subsistence to a numerous people, especially when they are necessarily resident in the country, adds to the prosperity of the state, and contributes to the direct emolument of the person on whose property they are placed, in a more powerful manner than perhaps any other circumstance whatever. Thus does a plantation of larches mediate, as a sort of creation of the human race. It calls beings into existence who never would have participated of life; and diffuses happiness and joy where gloomy solitude alone must long have kept her dreary abode.

The larch grows on almost any soil.—To show how these changes may naturally be effected, it is necessary here to recall what has been already said, that the larix can be made to grow upon almost any soil, even from a stiff clay to a barren sand, if not drowned in water; and in almost every situation where trees of any sort can be made to grow in this climate: so that no tree hitherto known is of such extensive influence. And though we shall soon see that it might be planted with profit, even upon good land, yet it does not refuse to grow upon the worst. Every proprietor of land, therefore, may, if he pleases, be benefitted by this improvement. If his land be good, the profits will be the sooner derived. If it be bad, they will be equally certain, though the returns will not be so quick, or the produce, in an equal number of years, so abundant.

A plantation of larches will yield some return in 6 or 8 years.—On good land, and

under skilful management, one who makes a plantation of larches, may begin to draw a return from his land in half a dozen of years, from which period he may draw a continually encreasing annual return for the whole remaining years of his life, and leave to his heir, at his death, a value in timber upon the land, worth perhaps ten times its original purchase-price. This is the direct profit : But when the collateral advantages that may be derived from an encreased population of prosperous people, in a country that is but in part improved, is taken into the account, the benefits are past computation, when plantations have been made upon lands that were originally of little value. And as to the objection, that if every one were to do this, the market would soon be overstocked, it is true : but as every one will not do this, those who first begin it, have the certainty of deriving the greatest benefit from their exertions. What a stimulus ought this to be for immediate exertions ! Before the first planted woods

come to full sale, the value of the timber will be known, and no quantity sufficient will be brought to market to supply the demand.

Uses to which young larch wood may be applied.—Hay rakes.—In six, eight, or ten years, according to soil and circumstances, the trees will have attained a size sufficient to be made into hay rakes, and several useful articles. This timber grows so straight; it is, at the same time, so light, so strong, and so durable, as to be peculiarly calculated for making hay rakes; and, from the peculiarity of its shrinking less than any other wood, these rakes must remain longer firm than those made of any other wood whatever. About two feet cut off from the root end, will form the rake-head; and five feet above that, with a very little taken off from the thickness of the under part of it, will form the handle. No wood is more proper for the teeth of the rake, than some larch taken from the red wood of an older tree, split

up for that purpose; because it is not only tough, but little liable either to split or shrink, and will, of course, be less apt to loosen than any other. The bow may be made of ash, or, what is still better, because both cheaper and lighter, though equally serviceable, of some of the wood of the laurel leaved sweet scented willow, (*Salix pentandria*) split up for that purpose. The making of these rakes, and other articles, will furnish employment throughout the year to many persons.

Shafts for hoes, handles for brooms, scythes, &c.—Many other uses may be made of the trees of this size. Among others, nothing is so fit for shafts to hoes: for it is nearly as strong, and much more durable than ash, which alone has been hitherto employed for that purpose; and the hoe-heads keep much better upon it than on any kind of ash wood. Handles for brushes, brooms, scythes, and innumerable articles of this sort, would occasion a vast consumption of these small spars.

Chairs.—Of the wood of this kind, also, might be made light, neat, and strong chairs for rush bottoms. In compliance with my wishes, some chairs of this sort were made of these small spires for a trial. The joiner objected to it at first, because it is found that when other kinds of wood are worked up with the heart in it, they are apt to split; and if fixed by boring only, they shrink so much as soon to shake loose, which it was expected would happen in like manner with the larch. The result of the experiment happily belied the prediction. The chairs keep firm.

Hop-poles, hurdles, gates.—In places where hop-poles are wanted, nothing in nature can be found that will answer this purpose so well as the larch: for one set of these would last against two or three sets of ash wood. Hurdles, spars, and gates, could be made of these, both lighter and more durable than other woods whatever; and when the trees are of a size sufficient for that purpose, they may be split down

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for cart shafts ; and, in mining countries, they could be employed as posts for supporting the roofs of coal-mines, and other uses of that kind, with singular economy.

Neat and durable railing, hen-coops, &c.—
The small tops cut off in making these various works, would furnish a neat, elegant, cheap and durable kind of railing, for being put upon the top of low walls, and other things of that kind, for ornament as well as use ; especially for preventing light sheep from over-leaping wall fences. One end of them might be let into the coping, whether made of sod, of clay, or of lime, as occasion required ; and the other end be received into a slip of sawn larch wood, with holes bored through it to receive their points. From the straightness of the wood, even without any work, this kind of rail would be made extremely neat, and at the most trifling expence. In the same manner might be made of these materials, hen-

coops, crates for packing glafs, and a variety of other articles, of which I have at present no knowledge.

Fences for fields.—But one of the moſt extenſive and beneficial uſes that would be made of this kind of ſmall wood, would be for the purpoſes of incloſing. Theſe ſpars, when the root cut was thick enough to admit of it, might be ſlit up the middle by a ſaw, and cut into lengths of five or ſix feet; or where ſmaller, they may be employed whole. As they are always ſtraight, and nearly of an uniform thickneſs, theſe, if driven into the ground for a few inches in a row, at a few inches diſtant from each other, with the ſplit ſides all in one ſide, and the round ſides on the other, would make one of the neateſt and moſt compleat fences that can be ſeen: The tops of theſe uprights being received into a piece of ſawed board, with bored holes in it for that purpoſe; and ſupported at due diſtances within ſide or without, by diagonal (ſloping)

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rances, reaching from the ground to the top : I have seen some fences of this sort, made of common Scotch fir, and nothing can be neater ; but unfortunately these want durability, which would not be the case of those made of larch wood.

Windows, joists, flooring, ship-building.—These are a few of the uses to which the small spires, arising from the first thinnings of these plantations, might be applied : As they advanced to a larger size, the application of them to the various domestic uses are so obvious and apparent, that it is quite unnecessary to enumerate them : It may be only proper to mention, that for windows, joists, flooring, panelling, couples, and every other purpose in building, these, if made of larch, would be much more perfect than any of the kinds of wood we have been hitherto obliged to employ for these purposes ; and for ship-building, especially plank, it would be evidently superior to the oak itself : so

that in a few years, this island would be able to supply within itself abundant materials for her own navy and numerous merchantmen; without being in danger of being obliged to depend upon foreign nations for these necessary articles; the prospect of which, for many years past, has occasioned so just an alarm among the people of Britain.

Barrel staves.—To these I shall only add, that the necessary articles of barrel staves and heading, might be furnished to ourselves without the aid of other nations. And this, if ever the fisheries shall be permitted to be carried on along our coast, to the extent they necessarily will be, if ever a Legislature shall be found so enlightened, as to perceive the benefits that would result from taking off those shackles that have condemned so many thousands of her best subjects to wretchedness and want, for centuries past, will be found to be a matter of much greater consequence than is at present imagined: for the unnecef-

fary expence of barrels, for these low priced articles, greatly inhances their price in foreign markets, and retards their sale, in the present situation of things.

Uses of larch brush-wood.—Hitherto I have only spoken of the uses that may be made of the *stems* of these trees; but there is not a branch, nor the twig of a bit of the brush, that may not be employed, with great economy, to some useful purpose. The larger branches might be employed for fencing of various kinds, and the smaller pieces of brush might be applied to the various uses I shall now specify.

For filling drains.—Wherever draining is wanted, which is the case in almost every district in this kingdom, nothing could facilitate this operation so much as abundance of larch brush. All other kinds of brush-wood are so perishable, that however desirable it may be, in other respects, to employ these materials, yet the drains are so soon choaked up by the rot-

ting of the brush, that it has been found necessary to resort to other materials, which cost a much greater price, in place of them. Hence drains are now almost universally filled with stone or brick; but these articles, even where they can be obtained, are so expensive, as to have greatly retarded the practice of under-draining, and, with that, diminished the general produce of the nation to an astonishing degree. As larch brush is nearly indestructible by rotting, this inconvenience would be thereby removed.

For fuel—In countries, too, where fuel is scarce, nothing could so well supply the want of it as the brush of larch wood; and here a peculiarity occurs, that greatly distinguishes this tree, in an economical sense, from all others. In regard to all other trees, considered as fuel, it is the *wood*, and not the small branches, which forms the best fuel; but it is quite the reverse with the larch, the *wood* of which cannot be applied to this use; but in return,

the small branches of this tree are found to make a fire nearly equally well with the larger billets of other trees. This is a discovery that was made, as most others have been, by accident, in the south of Scotland, a few years ago, that deserves to be generally known.

A gentleman, who owns a small estate in Etrick forest, where coals are at a great distance, and fuel very scarce, thought he could not employ a considerable part of his land to a better use than that of planting trees upon it, chiefly with a view to sell them for fire wood. At the beginning, he planted scarcely any other tree but the Scotch fir; but observing, by degrees, the superior luxuriance and rapidity of growth of the *larix*, he gradually began to plant some of these, encreasing the number more and more, from year to year, as he came better to remark their superiority over the others. When his plantations had advanced some years, he began to lop the under branches from the trees as they encroached on each other;

and carrying these branches to a side, he arranged them into lots of a convenient size for sale, and then sold them on a fixed day, by auction, to the highest bidder. As his larches came forward, he treated them exactly in the same manner; and arranging these in heaps similar to those of the fir, they were sold at the same time with the others. Soon after he began thus to prune the larches, he was not a little surprized to find, that a heap of larch brush sold readily at double the price at least that the same persons would give for one of fir of the same size. On asking the reason of this striking peculiarity, the purchasers ingenuously told him, that when they put a faggot of fir-brush upon the fire, it got up into a blaze, and was almost instantly consumed, so as to be of little service, and occasion much trouble and inconvenience; but when they put a faggot of larch upon the grate, it took fire more slowly, did not burn so fiercely, but continued, with a clear steady heat, nearly as long, and with as good effect, as

billet-wood of fir would do. Thus did experience teach them a lesson of the utmost consequence in rural economy, and clearly established the fact, that there is scarcely a situation in this island in which the smallest twig of this inestimable tree may not be applied to some very useful purpose in life.

I shall proceed to treat of the manner in which this tree may be reared with economy ; after having mentioned one other valuable article that may be drawn from it, without either hurting the tree, or diminishing its value in any respect.

Venice turpentine yielded by the larch tree.
—In the Venetian territories, where this tree has abounded for many ages, the natives have been long in the practice of extracting from it a semifluid balsam, which, from the place where it is chiefly procured, has obtained the name of *Venice turpentine*. There are two kinds of Venice turpentine : one of them is extracted from the bark of the *silver fir*, by a

peculiar process; this is deemed the finest sort. The other, which is somewhat inferior in quality is extracted from the larch tree. This resin of the larix is not found in the bark, but in the body of the tree itself. It is not to be obtained in considerable quantities from very young trees; and when the wood begins to grow more slowly through age, the turpentine gradually dries up, till at last it affords none at all: It is only after the tree has attained the thickness of ten or twelve inches diameter, that it is thought worth while to gather the turpentine; and from that time, for forty or fifty years, if it continues so long in vigorous growth, the tree will continue to yield an annual produce of from seven to eight pounds of turpentine from each tree. I do not know the exact price at which this substance sells; but believe it is from three-pence to four-pence *per* pound: suppose it to be no more than two-pence, and that the annual produce is six pounds, that would be at the rate of one shilling

each tree *per annum*. The gathering of which, though not expensive, would add to the employment of the people. The method practised is this :

A hole is bored by an auger into the tree near the root, slanting a little upward till it reaches near to the heart of the tree : Into this is fitted a kind of cock, to conduct the balsam, which oozes out of it in a semifluid state, into a vessel suspended at the cock for receiving it. This process is continued from the end of May till the end of September ; the operator usually going over the wood once a day, to examine the receivers, and empty what is collected into a general receiver to be carried home. When the trees will yield no more for that season, the whole balsam that has been obtained is pressed through a cloth to purify it, and is thus brought to market. It continues always in a semifluid state.

An English acre will contain 682 trees, at the distance of eight feet from each other : At the rate above mentioned, the

value of the produce in turpentine would be 3l. 4s. 2d. *per annum, per acre*; on the supposition that the trees should yield as much of that substance in Britain, as on the borders of the Adriatic gulf. Whether it will do so, remains to be ascertained by experience. I have never heard of a single trial that has been made in Britain, with a view to ascertain this circumstance. The produce above given, is mentioned upon the authority of M. Du Hamel, whose general character for accuracy stands high in the Republic of Letters.

Manne de Briançon.—In the south of France, they also gather from this tree a substance which is celebrated by the authors of Dauphinè, under the name of Briançon Manna. *Manne de Briançon.* It is found in the form of a hoary powder, early in the morning. With the value and uses of this manna I am a stranger, having never seen any of it. It is also said, that at Venice, the bark of this tree is em-

ployed for the purpose of tanning; but as the virtues of it in this respect are not known in Britain, I put no reliance upon it.

§ IV.

Directions for rearing Plantations of Larch Trees for Profit.

HITHERTO the larch tree has been cultivated in Britain chiefly for ornament, and it is only of late that the mode of rearing it with economy, *for profit*, has begun to be adverted to. It is in this last point of view, alone, I am at present to consider it; so that ornamental plantations must be here put out of the question.

It has been a very general practice in this country, to mix all kinds of trees together, in making a plantation, unless where these consist entirely of the Scotch fir. Fir plantations were very universally adopted till of late years, especially in the

northern parts of Scotland, where young plants of fir are reared at a very low price.

The larch should be planted entirely by itself.
—As larch plants begin to become common, a few of these were gradually interspersed among firs or other trees; but it has been found, by experience, that when this is done, in almost every situation or circumstances, the larch so much outgrows the fir, and every other tree, that it soon overtops them; in which situation, where the plants of larch are thinly scattered, at a distance from each other, they are exposed to the violence of the wind, without sufficient shelter, which bends and wastes their tender top-shoots, so as greatly to retard its growth, and to disfigure the tree.

Having observed this to be invariably the case, it occurred to me, above a dozen of years ago, that no plant could be found so proper for affording shelter to the larch, as the larix itself, which, if planted thick

enough, would soon intermix branches, and thus give and receive mutual support on all occasions. With this view was made the plantation of larches so often mentioned above, in which the young trees were at first planted at the distance of no more than two feet asunder. The consequence has been, that they have rushed up with a rapidity unknown in any other situation; and the trees are so straight, so clean, and so healthy, in all respects, as abundantly to prove that this is the proper mode of culture to be adopted wherever this tree is intended to be reared with profit. On this, as a sure foundation, the superstructure now to be described may be safely raised.

Difference between natural grown woods and plantations.—It has been often remarked, that no wood of the fir tribe, which has been reared in artificial plantations, has ever equalled in *quality* that which is produced spontaneously from seeds shaken by the hand of nature.

On comparing the natural with planted wood, the difference is found to consist in two particulars only, where the soil has been of the same sort. The natural wood is in general closer in the grain, and consequently harder and deeper in colour; and it has also fewer knots in it.

The reed of wood.—What is called the *grain*, or reed of wood, is formed, for the most part, by a series of circular rings running all round the heart of the tree, as is distinctly seen in a transverse section of the tree; each of these rings contains a harder and softer part, plainly distinguishable from each other, for the most part, by their colour also, which are formed by a series of tubes of different kinds, running parallel to each other from the bottom towards the top of the tree, that are separated from each other, at a lesser or greater distance, by a softer parenchymatous matter. These tubes, or fibres, are seen in every longitudinal section of the tree, running in parallel stripes, and con-

stitute what is called the reed of the wood. And as one of these rings is added to the circumference of the tree each year of its growth, and forms the whole increment of the tree for that year, it follows, that the less that increment is, or, in other words, the slower the trees grow, the less will be the breadth of these rings, and, of course, the closer the grain of the wood, and the harder also it will be: for it would seem that the number of tubes produced each year is nearly equal; but that the quantity of soft parenchymatous matter in which they are imbibed, is augmented in proportion to the quickness of the growth of the tree, which makes the reed both wider, and the general texture softer, than where it grows more slowly.

Knots in wood how produced.—These parallel stripes or reed never are interrupted in coniferous trees, except where a branch springs out from the body of the tree. In that case, wherever a branch inter-

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venes, it forms an interruption to the direction of the parallel fibres, which at that place are deflected into the position that the branch assumes, and forming a ring round the pith of that branch, the fibres run parallel with the pith of the branch in its longitudinal direction.

As these branches spring out from the stem, for the most part in a direction nearly at right angles with the stem of the tree, it follows, that when the wood is sawed into plank longitudinally, the saw, when it crosses one of these branches, must make a transverse section of it, as in the direction of the line of A. B. Fig. 1*f*. This forms the blemish in deal, called *knots*, the appearance of which is seen in Fig. 2*d*.

In regard to these knots, the following particulars are observable; viz. 1*f*, that the size of these varies in deals cut out of the same plank. If a deal were flit down in the direction of the line A. B, Fig. 1*f*, the knot in that deal would consist of no more than *four* concentric rings;

but if it had been slit in the direction F. G, it would in that place have consisted of *six* rings, and so it would turn wider and wider, as you receded from the centre of the tree to the circumference, or as long as the branch continued to grow.

Hence, as a necessary corollary, we must perceive that no *large* knots can ever be found near the heart of the tree, and that very large knots can only be found towards the circumference.

If, by design or accident, a branch be cut over smooth with the surface of the tree, the branch from that moment grows no more: but as the tree advances in growth, by the addition of a new ring each year, it gradually heals over the wound, and from that moment the ligneous fibres run over it parallel to each other, exactly as if no branch had ever been there, as in Fig. 3*d*; so that all the wood which is formed beyond that cut will be perfectly free from knots of any kind.

If the amputation has been made clear over at once, while the branch was still

Fig. 2d.



Fig. 1st.

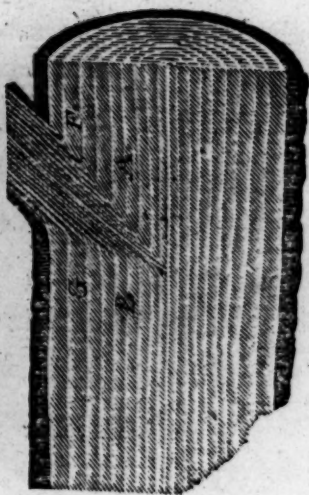


Fig. 3d.

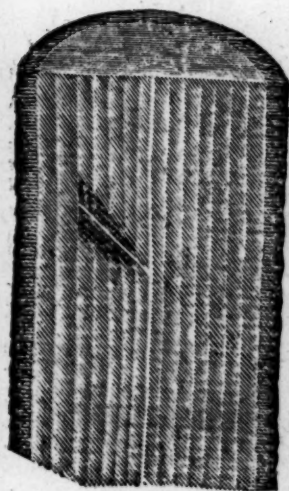
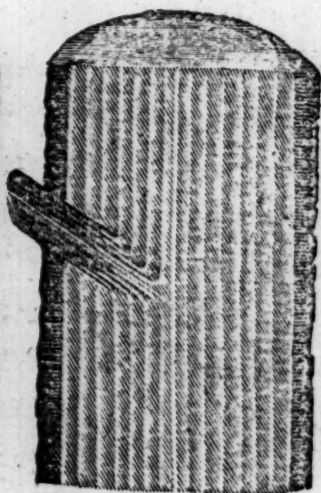


Fig. 4th.



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growing, the fibres of the trunk will be joined in continuity with those of the knot, and it thus forms a firm live knot, if the phrase be admitted; but if the branch die, and be suffered to remain adherent to the tree, that branch receives no farther additions; and although the tree continues to advance in size, and surround the branch, yet it has no farther connection with it than contiguity only; and it then forms a *dead* knot. The dead wood, in this case, when the deal is sawed across it on both sides, may be taken out of it as a cork, without force, and thus leaves a *hole*, in place of a *knot*, in the deal, as is plain by inspection of Fig. 4th, where the knot has continued alive till it reached the dotted line, till which time it received an annual increment, and had its continuity with the fibres of the wood uninterrupted; but from that period, being dead, it increased no more, and thus formed a hole in the deal through which it penetrated *.

* Some corollaries, to be drawn from the physical progress of a tree, might be here noticed, which will explain

The difference between natural and planted wood explained—By keeping these particulars steadily in view, it will not only be easy to account for the superiority of natural wood over that which has been planted; but, at the same time, we will be led to perceive in what manner artificial plantations of coniferous trees ought to be so managed as to approach as nearly as possible to perfection.

Some very common phenomena in the structure of fir wood. I shall only state a few.

Though every branch, as well as the stem, receives a ring of increment each year, yet as the branches do not encrease in size so fast as the stem, it follows that these rings are closer than those of the stem. And as it is found to be a rule, I believe without exception, that the closer these rings, the harder is the wood, and the redder the colour of it,—hence it invariably happens, that the knots are of a closer grain, redder colour, firmer texture, and more durable quality, than that of the wood itself, though usually more brittle also.

And as these qualities are augmented in proportion to the slowness of the growth of the one part, when compared with the other, it must happen that the smaller the knot is, if situated at the same distance from the heart of the tree, the firmer, and redder, and more durable it will be. These, when the circumstances are adverted to, are obvious corollaries.

In woods of coniferous trees, the progress, when left to nature, is this. The seeds being strewed very thick upon the ground, the plants, where the surface is favourable, spring up very close upon each other. Being straitened for room, their growth is stinted, and they hold a hard struggle, for some years, which shall get the better of the other. By degrees, the weaker plants are overtopped by the stronger, and die ; but still others struggle for life, and maintain the contest : and so it goes on without interruption during the greatest part of the period of their existence, or at least till they have attained a great height,—when the boughs of the most vigorous trees, spreading out above, overtop all those that are near, and thus a sufficient space is allowed for these to remain unmolested till they attain their full size.

During this long struggle for life, the progress is greatly retarded ; so that their growth is slow, and the fibres of the wood of course very close and hard. The side

branches, too, having no room to spread abroad, are kept weak and puny, and are soon suffocated by those above them, and die. In consequence of the agitation by winds, and the constant rubbing of the trees around, these dead branches soon are broken off and fall to the ground, before the stem has advanced far around the dead stump. It is no sooner rubbed off, than the bark begins to close over it. The stem thus becomes clear of branches and smooth, and all the wood that afterwards grows over it, is fine and free from knots. Hence it is that deal, towards the heart of the tree, is always much fuller of knots than nearer the circumference, though these internal knots, for the reasons above given, will always be of a smaller size than those that reach near to the outside of the tree.

In artificial plantations we follow an opposite course. Anxious to admire the progress of our trees, no measures are adopted for retarding their progress, at an early period, but rather the reverse: and

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were we even inclined to follow the progress of nature, the very expence of procuring and putting into the ground the plants, amounting to many millions on an acre, would prove a decisive bar to such enterprizes. The young trees are of course planted at a great distance from each other, and are encouraged to grow as quickly as possible, and thus to make the wood coarse in the grain, and soft. The branches, too, having room to spread wide on every side, advance with great luxuriance, and continue to grow till they attain a large size, and of course render the deal full of large and unsightly knots throughout its whole extent. Where utility and profit are aimed at, our attention should be directed to remedy these evils as much as the circumstances will admit.

To effect this, no method appears to me so easy to be reduced to practice as the following.

How to make planted wood resemble natural grown trees.—Though we cannot afford to

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make our plantations as thick as nature does, we ought to approach as near it as prudence will admit ; and, I am satisfied, that by planting larches at two feet distance, the benefits to be derived from the practice will do more than repay all expences attending it. Perhaps it might be still better, if the plants were placed at no more than 18 inches apart ; but not being *certain* of this fact, I shall, for the present, suppose, that two feet is admitted to be the most eligible distance *.

* Though I think it best in general to obtain young plants from nurseries, and therefore do not in the text enter into the minutiae of raising them from seeds ; yet where *very extensive* plantations are to be made, it will be best to raise the young plants. This has been the practice for many years past by the Duke of Athole, who has made more extensive plantations of larch trees than perhaps any other person in Europe : The mode of rearing them at Dunkeld is as follows :

Dunkeld method of raising larches in the nursery.—A well dug bed in your nursery garden being prepared, three inches deep of the earth must be removed from the surface of the bed, with a spade or the back of a rake : place the earth round the edges of the bed, and beat the bed with the flat spade. In the month of March, or beginning of

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Plantations should be made very thick.—At two feet apart, an English statute acre will

April, lay the cones very thick and quite close to or covering one another on the bed. About 10 or 14 days, or three weeks, according to the weather, you will find the cones have dropt a great deal of seed on the bed; rake them off, and lay them on another bed prepared in the same manner, then, with the rake, draw the earth over the first bed; proceed in the same manner with the second bed, and you may expect a full crop of larch plants or seedling:—cover them with straw or shilling-seeds, during winter,—let them remain next summer in the seed bed,—transplant them the following spring or autumn,—when they have been transplanted two summers, plant them out in your plantation ground,—make a small pit for them to loosen the earth, and set them into the hole, replacing the turf, cut in two, and with the earthy side of it uppermost: no soil suits them better than moors, with a peaty or black mould: the same cones will serve for two or three years.

These instructions I copied August 1795, from the mouth of one of the Duke of Athole's principal gardeners, and are the most perfect that ever were given, and will be found the most effectual for raising larch nursery.

G. D.

To the above I shall only add, that in nurseries, where they are reared in very large quantities for sale, a very different practice is adopted. In these cases, the cones are always split, and the seeds threshed and winnowed: they are sown in a bed of good garden-mold prepared as if for carrots or onions. The seeds are equally sown in

contain 10,890 plants*. For the convenience of thinning, and the other operations to be after mentioned, these ought all to be planted in rows, where the nature of the ground will admit of it. To do this, a small line, measuring sixty yards in length, ought to have knots tied up-

the month of April *very thick*; for it is found that, on an average, of the best seeds not more than one in three will germinate, and sometimes a much smaller proportion. They are covered with mold directly after sowing, as with onions, and smoothed by a light wooden roller drawn along each bed. The plants appear in a month or six weeks, with the seed husk upon the top, when they must be watched, to drive away birds, which would pick them up very fast, if not guarded continually, while they are coming up: afterwards they require no other care, except to pull up the weeds frequently before they get firm roots: If the season be dry and hot sunshine, it is a great advantage to shade them for some time from the sun by means of mats, otherwise they run a risk of being sometimes wholly killed by it; but in moderate weather, in this climate, they often escape unhurt, though unprotected. In very rich soils, some of them may be planted out when only one year old; but for the most part they may be allowed to stand two years in the seed-bed, and then be planted where they are to remain.

* A Scotch acre 12,960 plants, which is about 10,000 at the rate of 12 score *per* hundred.

on it, at every length of two feet, and a feather, a coloured rag, or other distinguishable object, stuck into each knot. This will mark the place where the trees should be put down. And if two men be employed, after stretching the line, at a proper measured distance from the last, each of the men begin at the end of the line, and putting down a plant at each mark, work till they meet near the middle, when they should turn back, shift the line, and begin anew; and so on they may advance till the whole field be planted.

The trees should be planted out while very young.—It is unnecessary to enter into minute details on this head. I would only beg leave to observe, that many advantages result from planting very small and young plants, in preference to those that are of a larger size. And this requires to be particularly adverted to, where they are to be planted so close as is here recommended. If the ground has been in illage, it will be a great advantage to

have it neatly plowed over, and harrowed before winter. At any rate, it ought to be laid dry, so as that no stagnant water remains on the surface, at any time of the year, if possible. With this view, the water-furrows, if it be plowed, and the soil retentive, should be neatly cleared out after harrowing. No weed is so destructive to young plantations as grass: for where that abounds, if the trees be planted, while of a small size, they will be infalliably overtopped by it and choaked; and if they be planted large, they seldom succeed well; many of them die; and it is long before the survivors take a full growth: so that, considering all these circumstances, and the expence of putting in such large plants, where the sward is tough, it will be more adviseable, in every such case, to cause the surface to be pared by the spade before planting; and these parings be either carried wholly off the field where the thin surface paring is wanted; or where that is not the case, by turning it over flat upon its back with the grassy

side undermost; and, in this case, if a little more than half the surface be turned over; it will cover the part upon which it is laid, so as to prevent the grass from growing up for some years; but unless it wholly overlays the sward, the grass will advance with great luxuriance round the edges, so as to render the paring of much less benefit than it would have been. Where the surface is smooth, and not too steep, or incommoded by stones, a plough might easily be contrived to perform this necessary operation.

Plantations must be compleatly inclosed and planted in squares.—We shall suppose the whole field to be thus prepared and *compleatly* inclosed, (for unless this is to be done in the most perfect manner, so as to guard against all intrusions, it is wrong to attempt ever to plant trees,) the plants will stand in regular squares, two feet apart, as in Fig. 5th.

In this state they may remain six, eight, ten, or twelve years, according to the

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richness of the soil, or the purposes for which the thinnings are wanted, when they should be thinned for the *first* time. The branches will in general intermingle with each other in the second or third year after planting; after which period they will give and receive mutual support, and advance for a time with vigour.

First thinning how to be made.—The first thinning ought not to be too long delayed, lest the tops, by growing too close, should be so much smothered as to occasion a hurtful gap when the thinnings are taken away.

At the first thinning, one row should be taken clean out, so as to leave the plants there four feet apart; and allowing three rows to remain entire, take out the fourth, as in Fig. 6th; and so on over the whole field. By this procedure, though the row on each side the open, will lose its support on *one* side, its branches, being still intermixed with those on the *three* other sides, will give it sufficient support. It

is necessary to cut out a row compleatly, to admit of trailing out the long spires together with their tops, which could not otherwise be done.

The second thinning.—In consequence of this open, the branches above will be permitted to grow more freely over the *open*; and in this state they should be suffered to remain till they there intermingle once more, when they should receive the second thinning, by taking out the middle row that was left at the former thinning, when the plants will stand as in Fig. 7th, in rows four feet apart, and two feet from each other in the rows. By this means, each tree is supported by those on each side of it *in the row*, whose branches are closely intermingled, as well as by those on one side, where first opened : so that still they are open only upon *one* side, while they receive support on *three* others.

The third thinning.—When the branches are closed in the last made open, the third

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thinning may be given by then culling out every fourth row *crosswise*, exactly as was done in the opposite direction in the first thinning, when the plants will stand as in Fig. 8th.

The fourth thinning.—After a proper interval of time, the fourth thinning may be given, by taking out the cross row that was left between the two contiguous to it. And now the whole trees in the plantation are once more reduced to squares, standing at 4 feet apart, as at Fig. 9th.

There will now remain at the rate of 2722 trees *per acre*: so that 8168 plants have been taken out during those successive thinnings.

Benefits to be derived from these thinnings.—This is the distance at which most people would have chosen to plant their trees at the beginning; but, in consequence of the management recommended, many benefits will accrue, independent of the profit to be derived from the sale of the

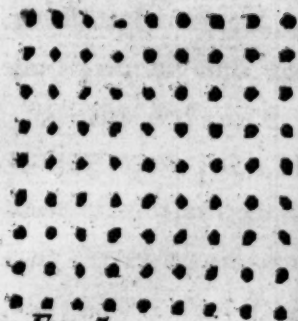


Fig. 5

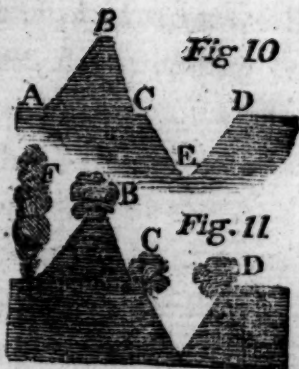


Fig. 10

Fig. 11

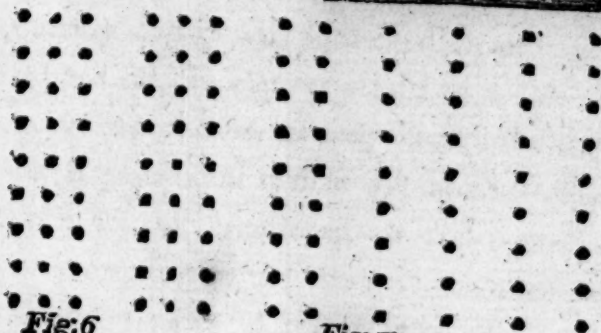


Fig. 6

Fig. 7

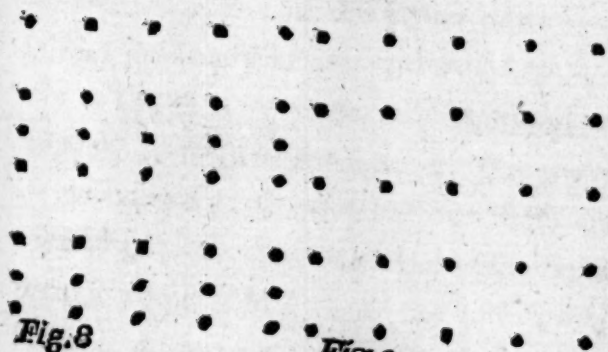


Fig. 8

Fig. 9

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thinnings, which, in most situations, will be an object well worth the attending to.

In the *first* place, the plants, by sooner closing upon each other, are for a short time after planting distressed by the wind, and therefore advance more kindly, and rise cleaner and straighter in the stem.

Secondly, The under branches, by being quickly suffocated, sooner die and are rubbed off, and never attain to a size to make large knots, as they must infallibly do, if planted at first so far apart. The stems are thus rendered to approach in some measure to the streight cleanness of natural woods. And if attention were bestowed to prune off the under branches, as they gradually begin to decay, especially of the few trees that are intended ultimately to remain for timber, the wood would be rendered even cleaner than the greatest part of that which is got from natural woods: And,

Lastly, By mutually checking the rank growth of each other, the wood will be rendered closer and finer in the grain

than it otherwise could have been; and this not only without any loss, but with great profit to the owner; as, instead of large dangling branches, which are of little use in any situation, he would obtain upright spires from the weedings, which, in every situation, may be converted to some useful purpose. And, in many cases, might be a source of great emolument.

Farther thinnings how to be conducted.—After a proper interval, the trees might be thinned, after the same manner as has been described, till they were gradually reduced once more to stand in squares, at *eight* feet apart, which is perhaps the greatest distance that ever should be allowed to trees of this kind: for by being thus circumstanced, their small tops would mix and support each other: they would have sufficient room to grow without starving; and by stinting each other in respect to nourishment, though each individual tree would advance more slowly than it would do if allowed more room;

yet there can be no doubt that a greater quantity of wood, *upon the whole*, might be obtained from the same extent of ground in an equal length of time, than if it had been thinner; and there is reason to believe the wood would be much finer in quality.

Yet here, as in regard to the proper degree of thinning, I have had no experience of the fact: I reason only upon probability, and therefore am far from speaking decisively. Should experience show that a greater degree of thinning may be given to these plantations with safety, doubtless the effects of it, in an economical point of view, should be tried; and that practice ultimately adhered to, which shall promise, on the whole, to be most beneficial. If thinning is to be at all adopted at this advanced age, it will require to be done with still more precautions, in order to insure mutual support, than when the plants are of a more humble growth; because the wind will have much more hold upon their tops, and will

act with a more powerful lever. When plantations of firs have been suffered to stand close a long while, and then suddenly thinned, without due attention to these circumstances, they are seen often to die, before they have attained an age at which their wood can be applied to any very useful purpose. In this point of view, these cautions, and the gradual thinning recommended above, to commence at a very early period, and never to be long interrupted, will be found to be highly beneficial, and ought not to be overlooked.

At eight feet apart, an acre will contain 680 trees: so that the trees cut out during the second process of thinning, have amounted to the number of 2042.

If the thinning be begun from the sixth to the tenth year from the time of planting, as circumstances shall indicate, the whole may be compleated thus far by the thirtieth or fortieth year of their growth, during which time there will have been sold 10,210 spars from 15 to 50 feet in height,

and proportional thickness, from each acre. If it be thought adviseable to continue the thinning farther, after this period, no whole rows ought ever to be cut out any where, but only a single tree here and there, so as not to deprive those around it of support too much at once. In this way, perhaps, the thinning might admit of being safely continued for an indefinite number of years, where the situation is not very much exposed.

Hints respecting the profit to be derived from these plantations.—I might now make a calculation with a view to show what might be the amount of the profits to be derived from this practice; but I have a great aversion to calculations of this kind: for as all the data must be mere hypothetical assumptions, it is the easiest matter imaginable for the calculator, in assuming a little more or less of these data, to bring out the result precisely to his own wish, without any striking obvious fallacy on his part. It is no part of my wish to

mislead the reader, but merely to inform him to the best of my power. From the facts already stated in different parts of this disquisition, every reader may, if he pleases, make out from these a calculation adapted to his own situation; for every person must be aware that more than four times as much money may be drawn for the same quantity of materials of this sort, in one part of the country, than in another. Doubtless if I had not thought that, after making a sufficient allowance for every unobserved contingency, the prospect of advantage to be derived from this practice, where adopted, was sufficiently inviting to encourage proprietors boldly to venture upon it, on a pretty extensive scale, in most situations, I should not have taken the trouble to enter so fully into the investigation on this occasion. Nor shall I add more on this head, except briefly to observe, that if we shall suppose that the sale of 10,210 spars, on an average suppose of 30 feet in length, from one acre, would be sufficient to de-

fray all the expences incurred on making the plantation and upholding it, which will not, I suppose, be deemed an unreasonable supposition in almost any situation:—and that each tree, at 50 years growth, instead of containing 360 feet of wood, as those at Dunkeld are known to do *,—these trees should, at the same age, measure no more than 70 feet each, which is less than one fifth part of the others: in that case the 680 trees on an acre would, at 50 years of age, contain 47,600 cubic feet of timber, which, at one shilling *per* foot, would amount to 2380*l*, from which, if you deduct the rent, which we shall for the present case suppose to be 5 shillings *per* acre, and which for 50 years is 10*l*. and interest for payments withheld, say 15*l*. more, in all 25*l*., there will remain 2355*l*. free profit; without taking into the account any thing at all for the arti-

* The reader may satisfy himself of this, by calculating from the actual measurements already given in this Essay. They are mentioned as supposed to contain 110 feet, which will be found exceedingly erroneous.

cle balsam, or any other contingency. The conclusion we are forced to draw from these facts, which do not seem liable to any valid objection, are sufficiently inviting, were more than three fourths of the sum to be deducted for unforeseen contingencies, as to be a sufficient inducement, one would think, for any reasonable person, whose situation admits of it, without throwing himself into embarrassing circumstances, to proceed without hesitation in this improvement. I surely can have no motive for inducing any person to attempt it, except the conviction that, should such plantations become general, the comforts of the lower ranks of people in this island would be much augmented; the general industry of the people greatly excited; and the wealth of individuals, as well as the general prosperity, receive by that means a very great addition. It is now about twenty two years since I first endeavoured to turn the attention of my countrymen in Scotland towards this useful tree, by some observa-

tions in a popular work that had then a very general circulation through Scotland *. It then attracted notice, and has, I doubt not, had its effect, along with other causes, greatly to extend its culture. At that time I suppose it would have been then a higher estimate, to suppose that 50 thousand larch trees were annually reared in Scotland. At the present moment, the demand for that tree is so much encreased, that from the nearest estimate I can make, one nurseryman in Edinburgh alone has raised this season above five millions of larch trees; and I do not suppose that, taking all Scotland together, there are fewer than twenty extensive public, besides a great many private nurseries, all of which are chiefly stocked with larches †. This affords a happy prospect of the

* Afterwards published by itself, in a volume, called, Letters on planting timber trees, by *Agricola*.

† The Duke of Athole alone has been in the practice, for many years past, of rearing himself, and planting out from his own nurseries, at the rate of two hundred thousand larches *per annum*, on an average of years.

benefits that the northern parts of this island will in time derive from this article. I am sorry to observe how comparatively few the plantations of larches are in England; and I also regret to think that, among the numerous plantations hitherto made in Scotland, there is so little prospect of obtaining much fine clean wood. Thick unmixed plantations of larches are but just beginning to come into use.

Sufficient fences necessary to protect plantations.—The necessity of protecting trees of all kinds from the intrusion of beasts, especially when young, is more generally admitted in theory than practice. I consider it, myself, as a *sine qua non* for rearing healthy trees of any kind; but in regard to the larch, it becomes so indispensibly necessary, that I should certainly dissuade any person from planting trees of this sort, unless he were determined, at all events, to have the ground so compleatly fenced at all times, as effectually to pre-

vent any intrusion of domestic animals; for, without this preliminary, he will reap neither pleasure nor profit from the enterprise. The larch, though it will sometimes recover its top, when the tender twigs of it are cut over, and admits of being cut in the side by scissars better than any other coniferous tree known in this country, yet it is extremely impatient of wounds in its *bark*; so that a touch there, which would scarcely be felt on any other tree, will make a *larix* perish entirely. For this reason it requires not only to be thoroughly fenced while young, but carefully protected even after it has attained a considerable magnitude. For this, among other reasons, I should prefer leaving the woods thick, even at an advanced age, to thinning them considerably: for thus grass will be prevented from growing below, and no temptation be given for putting cattle or other animals among the trees, which might injure their bark.

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Large inclosures recommended.—In order to diminish the expence of plantations, the inclosures should be made as large as the circumstances of the case will admit: for the larger these are, the smaller proportionally, is the expence of the plantation. This is a proposition so plain as to stand in need of no illustration.

Stone walls.—The nature of the fence must in many cases be determined by circumstances: where stones can be got very good, and at a small expence, walls may be made a very good defence against *cattle* for a time; but light bodied *sheep* will readily overleap them. Where larch spars are already to be had in the neighbourhood, a low rail of a foot, or 15 inches in height, formed of the top twigs stuck into the coping, slanting outwards, will prove a perfect defence for many years. Where this is wanting the wall can never be relied upon.

Ditch and bank fence.—In level situations, where the ground can be easily dug, a ditch and bank may be reared, as in Fig. 10. at a small expence. B. C. is a bank raised of sod four feet high, C. E. D. is a ditch four feet wide at top, three feet deep, and about nine inches wide at bottom. The earth taken from the ditch forms the bank C. B. A, the sod wall facing outward: A being the inner area for the plantation, this mound will not, in its present state, be an adequate fence against sheep; nor even for any length of time against cattle; but by adopting the following precautions, it will become in two years time a perfect defence against both.

Furze, its uses in fencing.—If there be sward upon the surface of the ground D, take off a sod from it, one foot in breadth at least, which may be employed in raising the bank B; and in its place lay some of the loose earth that comes out of the ditch; lay also some

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of that loose earth upon the ledget C, which ought to be left from 6 to 9 inches broad for that purpose, so as to cover the fward there. When the bank is finished, draw a small drill with a hoe all along at D, six inches back from the edge of the ditch, among the loose earth, and another drill at C close by the bottom of the bank; sprinkle seeds of the common whin or furze, *Ulex Europæus*, pretty thick in both these drills, and afterwards cover them carefully over with earth. These seeds, if good, will come up readily the following spring; but as it is of much consequence that no blanks should be in either of these drills, they ought to be carefully examined along their whole length, as soon as the plants appear, and the wants supplied immediately with fresh seeds, so as to prevent gaps: another row of furze seeds should be sown upon the top of the bank B, and the work is completed.

The whins at C. D. and B. will push out with vigour so as in most cases to at-

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tain the height of one foot each before autumn. In the year following, they will advance faster, and will effectually prevent sheep from jumping over; for they dare not come near the edge of the ditch to take their leap, and the bushes on the top at B. present a formidable scar in their face. And as to cattle, which, if allowed to go in the ditch, would gradually pull down the bank with their horns, if they should at any time get into the ditch, the two rows of furze nearly meeting upon their sides, would incommode and frighten them so much, as to induce them to get out of it as soon as possible, which they could only do by coming to the low side D. If they once got into that situation, they would feel it so disagreeable, as to guard carefully against coming there again.

The larix itself, its uses in fencing.—To preserve the furze from getting open at the bottom, one of the rows ought always to be cut over close by the roots each year;

1st, the row C. leaving D. and B. ; 2^d, the row D. leaving C. and B. ; and, 3^d, B. leaving C. and D. ; and so on alternately. In this way, the fence may be kept up for the space of ten or twelve years. After that period, the mound will in general crumble down of itself, and cannot be relied on as a sufficient fence. To prepare for this evil, which may be expected. The row of trees next the bank should be carefully preserved all around, and if planted originally at no more than one foot asunder, leaving an interval of three or four feet within, the trees will rise up by way of hedge, as at F. Fig. 11th, which, if made of larch, may be cut in the sides, if thought proper, by sheers, so as to thicken it quite down to the bottom. This kind of hedge may be soon made an effectual defence against animals of any sort, by the following contrivance. At the time the larches are planted, plant a sweetbriar between each tree. This plants grows freely. To make it still more luxuriant, let it be cut over by hedge-sheers *close* by the ground,

the first or second autumn after planting; the twigs to be drawn out and laid to a side. It will send out very luxuriant shoots next season, which, intermingling with the larches, now meeting each other, will push through the interval, and by its prickles render them difficult to be approached. The intermingled twigs of the larch and eglantine may be next winter pruned in the sides by the hedge sheers, which will make them grow closer. Let the eglantine be cut over close by the ground once more, but allow the shoots to retain their place; other shoots will spring up from the stems with vigour next season, and intermingle with the live larch and dead branches of the eglantine. The hedge may be dressed in the same manner next winter. The dead prickly stems will thus be encreased, and close all cran- nies. Through these will spring up fresh shoots of eglantine, and interlacethe whole together. By continuing this mode of dressing, and renewing it from time to time, as occasion may require, it will be-

come an impenetrable fence against any animal: so that when the bank fails, cross rails, if necessary, being fixed to these living supports, will form a perfect fence, that may be kept up with little expence as long as it can be wanted.

This fence may be compleated at the price of two pence *per* yard, in most situations. In some places, it may be less; in others, perhaps, a little more; but in every case, where the nature of the ground admits of it, it is a very cheap fence for this purpose, and will prove effectual.

The bramble, its uses in fencing.—A fence of still greater value, and which is equally applicable with the above in soft soils, and to those that are harder, in rocky and hilly countries may be thus constructed.

Let a bank be raised on the inner side of a ditch, where it can be dug similar to the former, and faced with stones, where these can be easily had, of a good bending quality; or, where the stones are small, or rounded, or fewer in number than

wanted, they may be laid in alternate rows with fods. This is a mode of fencing practised much about Caermarthen in Wales, and is found to form a compact and durable facing. Or where no stones can be had, the facing may be entirely of fod. The backing to be made of earth, dug either from the ditch, if on a level, or scraped from without in the best way it can be got, if upon a slope; or taken from behind where it can be easiest had; so as to raise the wall with its ditch from four to five feet high. Upon the top of this bank, and about one foot backwards from its edge, plant a row of *bramble* plants, at about six inches apart all around. These may sometimes be picked up from the commons; but, in this case, be sure to take none but young plants newly strewn and well rooted: all others should be rejected: for it is of the utmost consequence that the hedge should come away equally in all its parts, so as not to leave a single gap in any place. To insure this, in the most effectual manner, I should prefer in

general plants reared from seeds, to all others. And where many fences of this kind are to be made, seedlings will be not only the best, but the cheapest plants. For obtaining these, the berries may be collected when ripe; the juice squeezed out; the mark, containing the seeds, dried and kept till the spring; if then sown they will come up readily, as I should suppose, and will be of a proper size for planting out the winter after. Great care should be taken to examine the plants the first season after planting, and to supply every want that may be perceived; for if this be not done, the hedge will never afterwards be equal and uniform throughout its whole extent. I am induced to take notice of this circumstance so pointedly, from observing that a culpable carelessness, in regard to this most essential circumstance, is so observable almost universally, which is the chief cause of that raggedness in hedges that every where prevails.

It is perhaps scarcely necessary to observe, that in places where the ground without rises higher than that within the fence, it will be necessary to rear the bank to a greater height than elsewhere; and there also it will be proper to plant a dead fence of black thorns, or other brush wood, upon the top of the fence: If that be done at the time the brambles are planted, these live plants may be intermixed with the dead fence without detriment to them, but rather reverse: If the ground rise considerably, and if sheep abound in that neighbourhood, it will be proper also in these places to dig, or otherwise bare from grass the surface of the ground, for three or four feet on the outside of the ditch, and sow white seeds upon it, which will quickly grow up, and effectually prevent the sheep from getting there free footing to leap over the fence from the higher ground.

If the hedge has been planted with due care, it will come away with great luxuriance, and send forth annually a great pro-

fusion of luxuriant shoots, which rising upwards, and spreading out on both sides, forms a close matted coping of spiny plants all over, that will effectually prevent the intrusion either of men or other animals. To prevent the plants from establishing themselves at the bottom of the bank, it will be necessary to send a person each year, in the month of August, round the fence, with a sharp light hedge bill, merely to scutch off the tops of all such dangling shoots as discover a tendency to reach near to the bottom of the bank; for if they be allowed to touch the ground with their points, these points, wherever they touch, will directly strike root, and thus establish a new plant at the bottom, or in the bank itself, if of fod; from which others will spread around, to the great detriment of sheep, if they be allowed to come there, and to the hurt of the pastures, by whatever animals they are to be consumed: By this very trifling attention, this evil will be effectually ob-

viated,* and the fences kept as neat as could be desired, at an expence next to nothing: for a man could do all that is required, nearly as soon as he could barely walk round the inclosure.

The bramble resembles the rasp-berry in the mode of its growth, which differs from that of all other plants I know. Every year it sends out a great number of shoots from the bottom, which push out to the whole length they ever attain during the first year. The shoots of this season consist of single unbranching stems, unless where they have been accidentally cut over, when they become forked. The next season, these stems set out a great many fruit-bearing branches, along their whole length, which flower and perfect their seeds, while a new set of stems are pushing from the bottom to become seed-bearers next season. After perfecting their seeds, the whole stem that bore them, with all its branches, dies. This is the

* If any plants are observed to have struck roots in the sod wall, they should be pulled out, as observed.

natural and unvarying progression observed in the growth of this plant : so that a hedge of the kind I propose, will contain at all times three distinct kinds, of shoots, intermixed with and crossing each other in all directions : viz. *1st*, the dead shoots ; *second*, those that carry fruit ; and, *third*, those that are pushing forward in their longitudinal growth ; and as all of these are covered with strong spines, they form upon the whole, an impenetrable matting, when confined within proper bounds.

I have never yet seen any care bestowed to effect this last named purpose, and from this circumstance alone, the great utility of the bramble, as a fence-shrub, has never been properly adverted to. When neglected, it rambles to such a degree, as to become a very unsightly plant, and a mere cumberer of the ground. To the qualities it possesses in common with the rasp-berry, must be added that singular peculiarity the bramble alone possesses, of a faculty to strike roots at the point of the shoots of one year's growth ;

and this tendency is so strong, that wherever these points are allowed to lie upon the ground, they will infallibly take root in a very short time, after which time each of these becomes a new plant, totally unconnected with the former, unless by intermingling of branches; and thus they ramble wide, if neglected, and may quickly over-run a vast extent of surface. But what is not a little remarkable in this case, is, that no other part of the stem, except the point of the shoot alone, will strike root, even if it were laid into the ground: nor will any one of the fruit-bearing branches ever take root in any circumstances. Hence, then, the only thing required of the husbandman, in this case, is to take care that none of the dangling young shoots shall ever be allowed to rest upon the ground, on the outside of his fence; and he has nothing to fear. The slight dressing I have recommended, which, if never omitted for one year, will be the easiest thing imaginable; (because nothing but the tender shoots of that year

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require to be cut, which may be done by the slightest touch :) but should it be omitted for one season, not only would there be great risk that many young plants would by that time have established themselves, but also the old shoots of the former year being become tough and hardened, would be with great difficulty cut through ; so as to prove a very troublesome operation. Never could the old adage, that “ a stitch in time saves nine,” be better applied than in the present case

A good fence of this kind may be reared, in most situations, for a price not exceeding from two pence to three pence *per* yard : for a facing is only required upon one side.

Sweet-briar may be substituted in place of the bramble in a fence of ~~this~~ kind, if thought proper, as it will grow very freely in this situation ; but this is by no means so eligible as the bramble : for unless the sweet-briar be often cut over by the roots, it is apt to get naked below, ragged, and unsightly, if without support from other

plants; and if other plants be placed there, they grow poorly from want of abundant nourishment. In exposed situations, too, the wind gets hold of the tops of these shrubs, and by acting on these as a lever, is apt to pull down the whole bank, unless where it is made very strong. The bramble is liable to none of these objections; and it seems to be the very plant fitted by nature for forming that close netted prickly coping, which was wanted alike to prevent animals from tearing down this comparatively tender bank, and to preserve it from the levelling power of the air, and other external injuries. It is the business of man to avail himself of the blessings that nature has bountifully put within his reach.

Other kinds of fences might be named, equally cheap and efficacious, for low and fertile fields, as those are for upland barren soils; but these require not here to be specified.

Conclusion.—I will not enlarge upon the advantages that might be derived by private individuals, or the benefits that would result to the community at large, were a large proportion of the waste lands of the kingdom thus appropriated; as these are very obvious. Whether this shall take place, or not, I shall at least have the satisfaction, for my part, to reflect that I have not been wanting in my duty in this respect.

The cedar of Bermuda is well known to be the most valuable wood for building light and durable vessels, that have been yet built in any European settlement out of India. It grows quickly in Bermuda, and, by some experiments that were made by the late Duncan Stewart Esq. of Ardsheil, who lived sometime in these islands, the seeds were found to grow, and the tree to thrive in this country. What are the peculiarities of soil and exposure that will best suit that tree, have not yet been ascertained; far less is it known if it will grow properly in

waste and barren grounds. This ought to be fairly tried. With that view, it is my intention to order a considerable quantity of the seeds home; and I shall not fail to communicate to the public the result of these trials, should life be spared till that shall be known.

THE END OF ESSAY SECOND.

ESSAY THIRD.

HINTS

ON

THE ECONOMICAL CONSUMPTION

OF THE

PRODUCE OF A FARM.

Vol. III.

3 P

*Multum adhuc restat operis, multumque restabit, nec ulli
nato post mille secula precludetur occasio aliquid adjiciendi.*

LINNÆUS.

ESSAY THIRD.

HINTS ON THE ECONOMICAL CONSUMPTION OF THE PRODUCE OF A FARM.

No better proof can be adduced of the little progress that has been as yet made in the practice of agriculture in Britain, than that even the title of this chapter, nor any thing of a similar tendency, has ever found a place in any treatise that has yet been published on the subject of rural economics ; though it will be found to be a subject of very primary importance.

It may be admitted as a maxim, that agriculture can never be said to have been carried to its ultimate degree of perfection, so long as there is to be found one inch of ground that could be made to yield a single grain of greater or more valuable produce : so long as a single ounce of vegetable matter is allowed to go to

waste, or that has not been applied towards the sustenance of some useful animal, in the way in which it could produce its most beneficial effect: and while a single particle of dung or other manure is suffered to be misapplied, or so employed as not to afford the greatest possible resource it is capable of yielding, for the reproduction of additional crops of the most valuable kinds. That the highest degree of possible perfection should, in every case, be attained, is not to be expected in this imperfect state: but the nearer we approximate to it the better: and the more steadily we keep these objects in view, and the more strenuous our exertions are to attain them, we shall doubtless approach the nearer to these desirable attainments.

So far are these objects, however, from being steadily held in view, in the present age, that one who attends to general practice in Britain, would be induced to believe they were scarcely ever adverted to, unless by a very few persons, and in re-

gard to a small number of particulars only. Economy in the expenditure of the produce of a farm, like economy in the expenditure of capital in family affairs, seems indeed to be despised by many men, as indicating *poverty* of spirit, rather than wisdom, and is therefore studiously, as it should seem, avoided. There are, however, a few individuals, who have showed themselves to be above these prejudices, and who have not been ashamed to attempt to make some progress in different departments referable to this head.

Economical arrangements, were the subject to be considered in its utmost extent, as affecting the management of a farm, would take a much wider sweep than that to which I mean to confine myself in the present disquisition ; which is solely meant to relate to the consumption of the crude produce of a farm by animals : Nor can I pretend, in what follows in this Essay, to give absolute directions to the farmer what he ought to do, even on that part of the subject I shall

now bring under view. At the mere outset, in a business of such magnitude and intricacy, the person who first attempts to open up the view, can do little more than act in the humble station of a pioneer, who clears away a few obstructions that may enable others, with less labour, to penetrate farther than he has done: So that what follows under this head can only be considered as an exploratory excursion into an unknown region, from which only a very imperfect idea can be given of the subject. Craving, then, the indulgence of the reader, for unavoidable defects, and his friendly correction of those involuntary errors that his situation may enable him to discover, I proceed to suggest such hints as have occurred to me on a slight view of this interesting subject.

Much dung is wasted under the common practice of pasturage.—It is stated, in the agricultural survey of Gloucestershire, that one acre of rye-grass, which had been saved from Michaelmas to May, kept

nine ewes and lambs *one month*. We may safely say that the produce of the same field, from May till Michaelmas, would have been double to that it yielded during the winter half-year; consequently it could have sustained eighteen ewes and lambs one month. At this rate the acre of ground, taking the whole year round, would have afforded food for twenty-seven ewes and lambs for *one month*. These are large sheep, averaging about 25 pounds *per quarter*.

It is stated, in the survey of Wiltshire, that 500 such ewes and lambs are sufficient to dung an acre each day when folded upon it: at that rate, 27 of them should dung an acre in a little less than nineteen days; consequently, in thirty days, somewhat better than half an acre more.* Hence it follows, that if none of this dung were suffered to go to waste,

* I am inclined to think this will be but a very moderate dunging; but I state the facts as they are there stated. Should double the quantity of dung, or more, be required for certain purposes on particular occasions, it will not affect the conclusions deducible from these facts in *kind*, only in *degree*.

an acre of good land laid down to grass, in high order, should afford as much dung as would be sufficient to dress *an acre and a half* of other land each year.

Again,—It is stated in the agricultural account of Suffolk, that the rich marsh lands there keep at the rate of six sheep for seven summer months, and four for the five winter months *per acre*: that is, a little more than five sheep on an average *per acre* throughout the whole year. These are very large sheep, of which 800 would be equal to the 500 ewes and lambs above mentioned, and consequently would be sufficient to dung an acre in one day. But 5 times 365 makes 1825, the number of sheep kept for *one day*. At this rate, one acre of these rich grass lands would afford as much dung, in the course of one year, as should be sufficient to dung somewhat more than *two acres and a quarter* each year, if husbanded with due economy.

As the sheep in neither of these cases are folded, the dung is suffered to drop in

a scattered manner over the pastures, throughout the whole year. In this manner, the influence of the dung must either be nothing, or it must produce *certain* effects upon the grass. If the last, what will these effects be?

It is well known that when sheep are folded upon grass ground, so as to deposit their dung upon it in considerable quantities all *about one time*, as in folding, the effect is, that a flush of grass is quickly produced over its whole surface, which is much more luxuriant and abundant than it would have been, had it not received this dressing. But it is equally well known, that the animals, whose dung has occasioned that flush of grass, nauseate it; nor can they be brought to taste it, unless they be compelled through hunger to do so; although animals of another kind are seen to eat that kind of grass, [called in some places *goshk*, in other places *toth*,] not only without reluctance, but even with avidity.

The extra flush of grafs raised on the two acres and a quarter, that might be thus manured by the sheep fed on one acre, would be sufficient, on a moderate computation, to keep at the rate of two sheep *per* acre. By consequence, the extra grafs produced by the dung of the sheep kept on one acre of this rich grafs land, would be sufficient to keep four sheep and a half. But to keep within bounds, say *three* sheep only could be kept by the grafs produced from the dung of the sheep fed on one acre.

If the dung be supposed to have the same effect in producing extra grafs, when dropped from the animals as they pasture on the field, as it has when laid upon ground closely, by means of folding, it must follow from these premises, that as much grafs will grow from that dung upon each acre as would feed three sheep. But as the sheep will not eat this kind of grafs without constraint, the ground must either be so hard stocked as to compel them, through hunger, to eat that nauseous food,

or that portion of the grafs which is produced by the dung, will be suffered to run to waste ; so that, in either case, a considerable loss must be sustained by the owner.

This loss may indeed be avoided, in as far as respects the consuming of the grafs only, by mixing different kinds of stock on the same field, while in pasture. For if these animals can be made to associate together, so as not to disturb each other in the field, the one set of animals will eat up the rank grafs produced from the dung of the others, and thus the whole will be eaten up without waste. This practice is indeed sometimes adopted in Suffolk to a certain degree, where the farmers are in use to put among their sheep a certain proportion of calves, or horses, which, in some measure, answer this end. But as the general practice there is to stock with sheep only, the loss to the stock itself, which must arise from this cause, would be very great, were it not obviated by a circumstance which indeed diminishes

this evil, though this is in consequence of its producing another evil of nearly an equal magnitude.

If the dung, which is scattered about on the field, in small quantities, as it drops from the animals when pasturing upon it, were supposed to be incapable, in that state, of producing any sensible effect as a manure : or if that effect were very inconsiderable, in comparison of what it would otherwise have been, if applied all at one time, as in folding ; in either of these cases, the nauseating quality of the grass would not be experienced by the animals ; or in such a degree only, as not to prove considerably hurtful to them : for, in this case, the dung proving inert, it would do little or no service to the ground, and in consequence of that, would prove not in any sensible degree hurtful to the feeding of the sheep.

That the above supposition is literally true, seems to be proved by the very fact which gave rise to these observations. If the dung thus dropped produced a meli-

oration in any degree proportionate to what it would have done, if collected together, as in folding, its effects must have been extremely obvious in two respects; *first*, in augmenting the quantity of grafs produced on the field; and, *second*, in encreasing its nuseating quality; neither of which, at present, are very obviously perceptible.

In regard to the *first* particular. Every person knows that if a dunging, equal to more than double what is given by a good folding, were laid upon even ordinary grafs ground, it would at once make the produce nearly equal to that of the rich grafs lands in question. And though it be true, that the effect of such a dressing upon poor ground, would not be equally perceptible during the second year as the first, yet it would still be very considerable, insomuch that, although no other dunging were given to it, and the crops were constantly cut and carried off from the field, it would not return to its former state, but would continue to afford

much better crops than before it received the dressing, even for the third, and many succeeding crops. If the same dunging, then, were annually repeated, and if a similar effect were to result from each repetition, the quantity of produce must go on continually augmenting in a very rapid degree from year to year. But as no such rapid melioration is here perceived, we are forced to conclude, that the dung which is *thus* applied produces not the effect it might, under good management, be made to do; and that consequently an unnecessary waste is thus sustained.

If it should be alledged, that when land is once brought to a certain degree of productiveness, it can be made to yield no more produce, were it to be dunged ever so often; and that its richness could not be augmented even by folding itself, no more than it is observed to be by pasturing upon such land;—the want of economy, in suffering the dung to be thus applied, would be even perhaps still more

obvious than in the case before stated, For if the dung produces *there* no good effect whatever, there can be no doubt but it would produce a very powerful effect, if properly applied to ground of a poorer quality: so long, then, as such ground is to be found, those who suffer their dung to be so applied, must be held guilty of very great mismanagement, and of course should make haste to correct it.

The other circumstance above noticed is a corroborative evidence, that the dung thus laid on the field is allowed to waste itself in a great measure without effect: for had the nauseating quality of the grass been *nearly* as great as we know it must have been, if such a proportion of the grass had been forced by the dung of the animal which is set to consume it, this dislike in these creatures must have been so great as to be at once perceptible to every person; and must have *compelled* the farmers *universally* to adopt strong and decisive measures to guard against it: but as no such peculiarity is generally recognised,

we are forced to conclude that, if it does exist at all, it is felt but in a very inconsiderable degree ; and consequently that the great quantity of dung which is dropped upon these fields, operates not upon them in any sensible degree as a manure.

If these observations be well founded, what an amazing waste is sustained through the whole nation, by the loss of the dung that is thus uselessly scattered on the surface of pasture fields every where !

I am aware of the prejudice that is very generally entertained in favour of the benefits that grass land derives from the dung which is dropped by the animals that pasture upon it. But although I have searched diligently for a fact, or an argument grounded upon facts, to support this opinion, I am forced to declare that I have not been able to find one in support of it ; but, on the contrary, many, besides those above stated, which militate against it. I am therefore compelled to rank this as one of that nume-

rous class of opinions which have been at first casually adopted, and afterwards cherished, by a prejudice derived from habit rather than from reasoning of any sort. For such opinions I entertain no undue respect, and sincerely wish that the foundations of them were in all cases diligently enquired into.

Had this opinion been well founded, it must necessarily have happened, that in every case where grass-land has been long pastured upon, without folding, the quantity of its annual produce must have been sensibly augmented. That this has not been the case, we need only to open our eyes to be convinced of. It is only necessary to notice the immense numbers of poor grass fields in every part of this kingdom, which have been pastured from year to year without interruption, perhaps for ages past, and which discover not the smallest tendency to melioration of any sort, whether the quantity of produce within the utmost stretch of the memory of man, or the rent that has been paid for

them, [the alteration in the value of money being adverted to,] be considered as the standard. I myself know many fields which, under certain circumstances, have grown evidently less productive than before, though perpetually pastured upon. But as these cases are not perhaps so common in England, as in Scotland, I shall not farther insist upon them here. The forest of Dartmoor in Devonshire, and other such extensive moors of a barren nature, in many other parts of England, though every year stocked in summer with more beasts than the produce can properly sustain, do they discover the smallest tendency to melioration even till this hour? But there can be no doubt, that if all the dung which has been dropped upon these wastes had been properly husbanded, a great and sensible melioration on them must have been effected many ages ago, as I shall have occasion to show in the sequel.

Again, taking the converse of the proposition above stated,—Were it true, that

the dung which is dropped upon pastures tended sensibly to meliorate them, it must follow that those pastures from which the dung is constantly abstracted by folding, as on Marlborough downs in Wiltshire, and many other places, must either have grown worse in the course of ages, even where it had not been touched by the plough; or at least must have advanced much more slowly in their melioration, than other grass lands, equally untouched by the plough, from which no dung has been abstracted. Is this the case? I have not met with a single fact which tends to show that the present produce of the parts of those fields which have never been plowed, when compared with that of former times, differs in any respect from that of other fields of a similar nature, from which no dung has ever been carried away by folding.

Thus am I forced to conclude, that in all cases where animals are allowed to feed on pastures of any sort, the dung which is dropped from them is, in a great mea-

ture, lost as a manure; and a rigid economy would require that measures should be adopted for preventing this waste, if it can be done without occasioning evils greater than that which it is intended to correct.

Folding economical.—The remedy which first presents itself in this case, is that of folding; and if properly managed, there are perhaps few cases in which it might not be put in practice, not only without detriment to the stock, but even perhaps in some cases to their advantage. This was hinted at in the foregoing essay; but it is necessary I should be here a little more particular on this head.

All animals, but especially those that ruminate, choose to feed and rest by turns. Ruminating animals require much time for rest, and the more quiet they are allowed to be during that period, the better they will thrive. If these then are withdrawn from their pastures after they have properly filled their belly, and when they

become necessarily disposed to ruminate, they can sustain no damage from being then put into a place where they can have no access to food. And if they be only as long detained there as till they have rechewed the food they had swallowed, and begin to feel an inclination to eat more, they will even be benefited by this confinement, rather than otherwise. For, in these circumstances, the creatures will thus be induced to feed and to rest all at the same time, so that when they are at rest, they are allowed to be wholly so, and can suffer no disturbance from one another, nor from any other cause; whereas if they be left at liberty to range over the whole field at large, at all times, they are not determined, as men are from habit, all to enjoy their meal at the same time, and thus to feed and rest as it were in concert; but each individual is left at random to feed or to ruminate as chance shall direct. Thus it happens that they seldom are seen all at rest, at the same time. While some indivi-

duals are disposed to ruminate, others are inclined to feed; and as they move about while feeding, the feeders disturb those who are at rest: for being all of them gregarious animals, while one who ruminates lies still, the others are moving forward; so that all such seeing themselves in danger of being left behind, are forced to rise and follow the rest, that they may regain those which are feeding. Thus it is, that though apparently left at freedom to rest when they please, they are actually put under a kind of constraint, and are forced to move about when they wish to lie still; whereas by an attentive mode of penning, all this disturbance will be entirely avoided, and they will be suffered to enjoy a repose as uninterrupted as their hearts could wish.

That penning, however, under injudicious management, may tend to retard the feeding of the animals subjected to it, cannot admit of a doubt. If the creatures be driven to a great distance from their pastures to the pen, it must subject

them to a hurtful degree of fatigue ; and this will be encreased if they must be made to pass through narrow lanes, where they may be crouded and incommoded by passengers ; or where they cannot avoid being at times mired in dirt, or drenched in wet : or if they be neglected too long in the pen ; or put up at improper times, &c. In some cases, owing to these circumstances, it may admit of doubt whether the stock itself does not suffer more damage than the benefit that results from the collecting of the dung : but from the abuse of a beneficial practice, we must not reason against the proper use of it.

To derive the full benefit from folding of which it is susceptible, it would seem, that where the pastures are of great extent, there ought to be two or more folds placed close by the pasture, at convenient distances from each other ; so that the flocks being gently conducted from one towards the other, feeding all the way, might find themselves, when full, just at the place into which they

might retire for rest. There they should be suffered to remain just so long as is found by experience to be necessary to compleat their ruminating process, and to prepare them for feeding afresh: they should then be suffered to rise and stretch themselves, when they naturally void their dung and urine on the spot. Thus will the dung be preserved, and the pastures be kept clean and sweet. They ought then to be led gently to the fresh pasture which they had not lately breathed upon, or trampled with their feet, and which of course will be to them sweet and inviting; they should thus be slowly conducted to their next resting place, feeding all the way; and so on till they go over the whole in a regular succession. If experience shall discover that diseases are produced by suffering the animals to eat their food when covered with hoar frost, or dew, or mildew, or at certain times of the day or night, when snails or other creatures are abroad, which they may swallow with their food: In all these cases, when ob-

served, the evil may, by an attentive economist, be avoided by means of a judicious use of the fold. He may, also, by the same contrivance, withdraw the creatures from the pastures at those times when they become restless and refuse to feed. In short, a judicious economist, by having folds properly situated, respecting the circumstances of shelter, coolness, water, and other conveniencies, may avail himself of these for greatly promoting the health and enjoyment of the animals, and thus accelerating their feeding; so that, independent of the benefits he shall derive from their dung, he will in other respects derive considerable emolument. But where is the man who thinks of these things in the present day? They are despised, and therefore unknown.

In order to obtain some idea of the benefits that might be derived from penning, under a judicious system of management, when compared with suffering the produce to be consumed by animals which are allowed to pasture at large,—let us

put the case, That two classes of fields, each class consisting of two fields of equal extent and alike in all respects, the one class consisting of bare pasture, and the other of rich grass land ; each field of the same class being stocked with the same number of sheep,—were put, the one under the folding system of management, and the other under that of the unlimited pasturage system, and continued for a number of years,—and observe the result.

Say then, first, that the pasture was naturally so poor as, at the outset, in both cases, to be fit to sustain no more than at the rate of half a sheep *per* acre ; and at that proportion was of extent sufficient to nourish one thousand head of sheep, consequently of 2000 acres extent.

We have already seen, that where the beasts are allowed to range at large, such a field will continue for ages without the smallest augmentation of its produce ; and that, of course, if it began with a thousand head of sheep, however long the experiment were continued, that farm, the pro-

duce of which was so consumed, would continue to the end to keep only the same thousand head of sheep.

In regard to the farm where folding is practised, let it be admitted that the extra flush of grass produced on an acre, upon which one thousand sheep had been penned for one day, would be sufficient to sustain one sheep more the first year after folding, than it could have done without it, half a sheep the second year, and a quarter of a sheep the third year, beyond its original proportion ; and that, after the third year, the extra produce should be counted at the rate of $\frac{1}{4}$ of a sheep *per* acre for many years. Most persons will suppose this an under-statement : some may suppose it an over ratio ; but all will admit that the encrease must be something. I state it thus merely to show the general result, not the precise amount of that result ; so that every individual may alter the rate till it suits his own fancy. The general conclusion will not be altered by that circumstance.

On these data the thousand head of sheep ought to dung in one year 365 acres: but to make allowance for bad weather, and other contingencies, let us deduct from that 165 days; and say that only 200 acres were dunged to a sufficient degree by that number of sheep in a year. By tracing the progress, the annual account will stand thus:

First year.

<i>No. of Acres.</i>	<i>No. of sheep kept.</i>	<i>No. of Acres dunged.</i>
2000 at half a sheep <i>per</i> acre	1000	200

Second year.

200 $1\frac{1}{2}$ year after dung $1\frac{1}{2}$ do.

per acre — 300

1800 do. original at $\frac{1}{2}$ do. *per* do. 900

2000

Total this year 1200 240

Third year.

200 2d year at 1 sheep *per* acre 200

240 $1\frac{1}{2}$ year at $1\frac{1}{2}$ do. *per* do. 360

1560 original at $\frac{1}{2}$ do *per* do. 730

2000

Total this year 1290 258

It is unnecessary to carry this calculation any farther. The gradual meliora-

tion is, in this case, established beyond a doubt, which, if continued for a great number of years, must produce a sensible improvement in every part of the country. I beg leave, however, once more to observe, that I do not contend to have attained any absolute accuracy in the *quantum* of the melioration above stated: all I contend for is, that by a management similar to the above, a progressive melioration would be unavoidable, the *ratio* of which might be in some cases, greater, and in others less, than here stated; but that in every case it must be sensibly perceptible in the course of a great number of years. As no such melioration, however, is perceptible in fields subjected to pasturage alone, that practice must be deemed highly uneconomical.

Neither let it be understood as if I recommended the mode of penning above stated, as the best mode that could be devised of applying the dung. It was selected merely for the sake of simplicity, for the purpose of illustration. What is

the most economical mode of applying dung for the purpose of agriculture at large, may come to be afterwards considered : at present it could tend only to embarrass the subject in hand, which is the economical consumption of the produce of grass land : these few hints being only a digression, to show in what manner the farmer may prevent his lands from being fouled without inconvenience, and even with profit to himself.

Let us now consider the case of rich pasture fields : And, with a view to avoid the dilemma that might accrue from the supposition that very rich land derives little or no benefit from dung, we shall put the case, that the dung of the fold, in conjunction with lime, and such culture as the nature of the soil may require, can be applied to some poor ground of little value in the neighbourhood, to be put under corn.

Suppose in this case, again, that the rich grass field is capable of sustaining also one thousand head of sheep ; and let us

for the present take it for granted, till we can overtake it, that the produce will not be diminished by abstracting the dung of these sheep from it.

In this case, on the foregoing data, the dung of the sheep would be sufficient to manure 365 acres; which, as in the former case, we shall moderate to 200.

Let us suppose that the encreased crop, in consequence of the dunging for the *first* year, is equal to two quarters of barley *per* acre. The *second* year, white and yellow clover with rye-grass, equal to the feed of 3 sheep; *per* acre. The *third* year equal to $2\frac{1}{2}$ sheep; and every year after that it should be equal to 2 sheep *per* acre.

The first year would be

<i>Sheep kept heads.</i>					<i>Land dunged acres.</i>
1000	—	—	—	—	200

Second year.

1000 head on the original field as before	—	200
200 acres of barley at 2 quarters, 400		
quarters at 24 shillings	—	L. 480
Total	L. 480	200

Sheep kept.

Third year.

Acres dunged.

1000 sheep as above	—	—	200
600 more on the 200 acres dunged grafs land first year, at 3 head of sheep <i>per</i> acre, which would dung	—	—	120
200 acres of barley as before	L. 480	—	—
1600	Total	L. 480	320

Fourth year

1000 head of sheep, as at the beginning	—	—	200
500 do. on 200 acres of grafs the se- cond year, at $2\frac{1}{2}$ head <i>per</i> acre	—	—	100
600 do. on 200 acres of grafs the first year at 3 <i>per</i> acre	—	—	120
200 acres of barley at 2 quarters <i>per</i> acre 400 quarters as before	L. 480	—	—
2100	Total	L. 480	420

It is unnecessary to proceed farther in this enquiry; for the progressive improvement here is great and obvious, let what deductions you please be made for errors or exaggeration. Every one may reduce this to the standard that pleases himself best; the same conclusion is unavoidable.

I consider it then as a truth undeniably established, that dung, dropped upon a field in pasture, either produces no effect whatever, or an effect far less considera-

ble than it might be made to afford under a more judicious system of management ; and that, if it has any effect at all upon the pasture, it must be that of rendering the food yielded by these pastures less palatable, and less nourishing to the animals that feed upon it, than it otherwise might have been. To obviate this evil, which is every where felt by attentive farmers, especially upon rich pastures, different persons have adopted different devices, all of which are liable to strong objections in point of economy.

Hard or light stocking of pasture ground.—Some persons contend, that the pastures ought to be stocked very lightly ; alledging, that although much of the produce is thus allowed to run to seed, which the beasts will not eat, and which of course is trod underfoot, and rotted by rain, and thus wasted ; yet experience, they say, proves, that a greater profit will be thus derived from it, upon the whole, on ac-

count of the superior thriving of the animals, than by any other practice.

Others pretend, on the contrary, that light stocking of grass land is a practice highly to be condemned ; as it tends not only gradually to diminish its produce, but also to encourage the growth of coarse and unprofitable grasses, which greatly deteriorate the pastures ; and that hard stocking of grass lands, especially those of a rich quality, is an indispensable requisite of good management.

These two opinions, so diametrically opposite to each other, and which are equally maintained by sensible men, clearly proves the embarrassment to which they are subjected, in consequence of their not having adverted to the circumstances stated above, and many other particulars that require still to be developped, as affecting the economical consumption of the produce of grass lands.

A third party, who approach perhaps nearer to the truth than either of the above, advise that a mixed stock should be

always kept upon the same field : and were the consumption of the foul grafs produced by the dung of the animals, the only article to be adverted to, it might be, doubtless, so managed as to correct this evil : But there are so many other circumstances to be adverted to, that it is not easy, by this means, to get them all remedied.

In every field, a variety of plants spontaneously spring up, some of which are disrelished by one class of animals, while they are eat by some others ; and some of which plants, though eaten readily by some animals at a particular period of their growth, are rejected by them entirely at another age. Thus it becomes necessary, not only to have a vast variety of animals in the same pasture ; but also a very particular attention is required to augment or to diminish the proportion of some of these classes of animals, at particular seasons of the year, otherwise some part of the produce will be allowed to run

to waste, unless it be hard stocked to such a degree as to retard their thriving.

But if a great variety of animals be allowed to go at large in the same pasture, they are never suffered to feed with that tranquillity which is necessary to insure thriving in the highest degree. One class of these wishes to feed, or to play, while the others would incline to rest. They thus mutually disturb and teaze each other: and this inconvenience is greatly augmented, if penning of any sort be attempted. From these considerations, the practice of intermixing various kinds of stock very much together, is found to be productive of evils, in many cases, greater than those which result from the waste of food they were intended to prevent. And though there can be no doubt that by hard stocking the grass will be kept shorter, and consequently will be more palatable in general to the animals who eat it, than if it were allowed to run to a great length, and that thus even unpleasing patches may be consumed; yet as animals

which are to be fatted, must not only have sweet food, but an abundant bite at all times, to bring them forward in a kindly manner, it seems to be nearly impossible to obtain both these advantages together in the practice of pasturage.

Cutting and consuming the produce in the house.—Might not these evils be greatly diminished, if not entirely remedied, in many cases, by having the produce cut by the scythe, and given to the animals fresh in the house; rather than to suffer them to go at large and eat the produce on the field, even under any system of management whatever?

Many arguments tend to show, that this practice would be, in general, highly economical.

In the *first* place, if the consumption of the plants be the object principally attended to, it is plain the benefits will be great: for experience has clearly proved, that there are many plants which are greedily consumed by beasts, if cut and given to them

in the house, which never would be touched by them when growing in the field. Of this nature is the dock, cow-parley, (*Cbærophyllum Sylvestre*) thistles, nettles, and many other plants. Upon what principle it should happen that these plants should be so readily eat, when thus given, while they are totally rejected when in the field, I cannot say : but that they are thus eat, without reluctance, even when the animal is not hurtfully hungry, is evident from this circumstance, that the beasts often fall greedily to these at the moment they are brought in from the field, even before they have had time to become hungry after they had come in. Thus fewer plants will be rejected or suffered to go to waste.

In the *second* place. It is well known that many of even the best kinds of grasses, which when young form the most palatable food for the creatures, if once suffered to get into ear, are disrelished so much as never to be tasted by them unless to prevent starvation ; and as, in most

pasture fields, many of these grasses get into ear from various causes, all the produce of these plants is inevitably lost to the farmer. But if cut down by the scythe, in proper time, not one of these is ever suffered to get into that nauseating state; and consequently no waste is sustained from this cause.

Thirdly.—When animals are suffered to go upon the field, many of the plants are trodden under foot by the beasts, and bruised or buried in part in the earth; in which state they are greatly disrelished by animals, and are suffered to run to waste; which never could take place were the practice of cutting adopted. And,

Lastly, on this head. Those few plants which are totally disrelished by one class of animals, so as to be rejected by them even in the house, will not, from this circumstance, become less acceptable to others, but much the reverse. Food that an animal has breathed upon, for any considerable time, becomes unpleasant to other animals of the same class; but not so

to those of another species : It seems indeed thus to acquire for them a higher relish. Even greater defilement by one animal, seems to render food more acceptable to others : For straw, that in its clean state has been rejected by cattle, if employed as litter for horses, acquires a relish for cattle that they search for with avidity. Hence it happens, that the sweeping of the stalls from one animal, furnishes a dainty repast for those of another kind ; which can easily be shifted from one to the other, if the plants are consumed in the house, but which must have been lost in the field. We shall soon have occasion to show that this peculiarity may be employed to answer another useful purpose.

In the *second* place. If *the health and the comfort of the animal* be chiefly adverted to, the balance will be clearly in favour of the cutting system, when compared with that of pasturing. It is well known that when animals are exposed to the sun, in the open air, they are not only greatly

incommoded on many occasions by the heat, but also are annoyed by swarms of flies, gnats, and hornets, as well as the terrible gad-fly, which drives them into a state of perturbation little short of fury, which must obviously tend to retard their thriving. At other times they are hurt by chilling blasts, or drenched by cheerless rain, which renders their situation very unpleasant, and greatly retards their feeding, as is well known. Under proper management, in a well constructed stall, all these evils would be alike removed, and they would be kept perpetually in a proper state of coolness, tranquillity, and ease, so as to make the same quantity of food go farther than it otherwise could have done in nourishing them. They would also be prevented from licking up snails, worms, and other noxious creatures, among their food, which they are by pasturing apt to do, when they feed at those times of the day, or night, when these creatures crawl abroad. This would be entirely avoided by cutting the grass at

those times of the day when none of these are to be found. Thus lingering diseases might often be avoided, which always retard the thriving, and often prove totally the destruction, of the animal. And, *lastly*, by giving an opportunity of administering dry and nourishing food, along with the soft and succulent, where circumstances require it, in any requisite proportions, and by varying the tastes, so as to provoke an appetite, not only the health, but the thriving of the creatures, would be greatly augmented beyond what they otherwise could have been.

In the *third* place. If *manure* is to be chiefly attended to, there can be no comparison between the two modes of consumption. This is so greatly in favour of stall-feeding, that it would be idle to spend time in searching for proofs of a proposition that may be considered as self evident.

In the *last* place. If the *quantity* of herbage produced from the same field be adverted to, it will be found to be equally

in favour of the cutting system. It is well known, that all animals delight more to feed on the young fresh shoots of grass, than those that are older. Hence it invariably happens, that those patches in a pasture field that happen to have been eaten once bare, in the beginning of the season, are kept very short ever afterwards throughout the whole of that season, by the creatures delighting to feed upon them in preference to the parts of the field that have got up to a greater head ; so that these last are suffered to remain, in a great measure, untouched, throughout the season. It is not, however in general known, that grass, even the leafy parts of it, when it has attained a certain length, becomes stationary ; and, though it will retain its verdure for some months in that state, makes no sort of progress whatever ; whereas if it had been cropped down frequently, it would have continued in a constant state of progress, advancing with a rapidity in a great measure proportioned to the frequency of its being cropped. For experi-

mental proofs of this fact, see *Essays on Agriculture and Rural Affairs*, Vol. II, Disquisition V. Nor has the diminution of produce that must thus be incurred, ever been adverted to by persons who are interested in it; nor have these circumstances entered in any respect into their estimation. From my own experiments and observations, however, I am satisfied that, in some cases, the actual produce of the same field, by a judicious management *in this respect*, compared with bad management, may be augmented *fourfold* in the same season. It is owing to this circumstance, though the reason of the fact has not been understood, that hard stocking of pasture lands has been found to enable the same field to sustain a much greater weight of stock than it could do when lightly stocked. But under no system of management, can the evil of unequal cropping of land under pasturage be avoided, unless it be by a destructive degree of hard stocking, which must be avoided where the animals are expected to thrive. By cutting

with the scythe frequently, so as to keep the grass always short, and therefore in a state of continual vigorous vegetation, all these evils are avoided. The quantity of produce will be raised to the *maximum* that the land, in its present state, is capable of producing, while the stock to be fed by that produce needs not be in the smallest degree stinted in point of food.

Under every point of view, then, that this question can be considered, we are forced to conclude that the practice of cutting grass, and consuming it green, in all cases where the ground is in a state that can admit of it, when compared with that of pasturage, appears to be so greatly economical, that the particulars under which that mode of management can be practised, and the peculiarities affecting it, deserve to be much more minutely investigated than they ever yet have been.

In confirmation of the justness of this conclusion, it is now universally admitted as a fact, confirmed by innumerable experiments, that a crop of red clover, when

cut, and consumed in the house green, goes in all cases much farther in feeding beasts, than when it is consumed by pasturage upon the field. The lowest estimate that I have ever seen made on this head, from actual experiment, is, that it will go at least twice as far when cut, as when pastured upon : some go as high as to say it will go *four times* as far. As every person, who has tried the experiment, agrees that the saving, by cutting this crop, is very great, that practice has of late years begun to prevail very much ; though reason has not yet been able so effectually to stem the torrent of antient prejudice, as to render it entirely universal.

But the practice of cutting other grass grounds, and consuming their produce green, seems not yet to have been deemed even practicable, and has not of course been ever thought of being experimentally tried, although I have reason to be satisfied, from some experiments that I myself have made, and the considerations above stated, that the benefits to be

derived from consuming the produce of rich grass lands *of any sort*, in this way, will be even greater than that which takes place with regard to red clover.

The circumstance that made me first advert to those benefits that might be derived from consuming grass land by cutting, in preference to pasturage, was merely accidental. I had a pretty long and broad grass walk, leading from my dwelling house to a garden, which could be avoided, when inconvenient to walk upon it, by taking another path: And as the pile upon this avenue was extremely close, I found it very pleasing to walk upon it, while free from wet, even when the grass was an inch or more in length. Instead therefore of having it close shaven like a lawn, every three or four days, and throwing the sweepings away, as usual, it occurred to me that by cutting it less frequently, I should be able to have all the use of my walk I wished for: while I would at the same time, lose no part of the produce. From these considerations,

I resolved to have it cut so as to admit of being given with economy to my cows, while in the house. As much grass was, therefore, cut each day from it as served my beasts for the time; and so proceeding on regularly, first cutting one side of the walk from end to end, and then the other, the walk being frequently rolled when fresh cut, especially after rain, to keep the surface smooth, so as to allow the scythe to cut quite close. In this manner I not only effected the purpose originally intended, but, to my great surprise, I had soon occasion to perceive that I thus obtained food for beasts much greater in quantity, as well as sweeter in quality, than I had ever been able, under any other mode of management, to obtain from the same extent of ground. The grass was cut six or seven times during the season; and at each time the quantity, on account of the extreme closeness of the pile, was much greater than I could have supposed, and of a much sweeter quality also. There was not in the whole

a single blade of grass that was either bruised or decayed in any way, so that the beasts devoured it with inconceivable avidity; whereas if, upon such rich land, it had been allowed to stand a little longer, the root-ends of the grass would have begun to wither and turn musty for want of air, though the top continued green; some stalks also being choaked by others, would not only begin to rot, so as to become unpalatable to the animals, but their roots also being suffocated, begin to die out, and the grass becomes thinner, so as to be longer of springing up after each cutting; and thus the *quantity* of the produce is diminished, as well as its *quality* much impaired. Some farmers, to whom I showed this experiment in the course of its progress, judged, when they looked at the grass while growing, that it would be too short to be worth while to cut it; but when I caused some of it to be cut before their eyes, the *quantity* laid down by each swathe was so much greater than they expected, as to excite a

high degree of astonishment. Some of them even admitted, that the quantity of forage thus obtained at one cutting, though it did not, at the most, exceed two inches in length, was in their opinion equal to that obtained at one cutting of a field of red clover, when advanced to be in full flower; and my own opinion coincided with theirs. This experiment first suggested doubts in my mind, as to the propriety of consuming *rich* grass lands by pasturage; and every observation I have since made, has tended so strongly to add to my conviction, that I have now not a doubt remaining upon this head; and I conceive that the loss which is annually sustained by the nation at large, from an inattention to this circumstance, is so great as, in some measure, to call upon me to publish these remarks, with a view to direct the attention of others to investigate the subject with greater care than it has hitherto obtained: for, however inattentive men may be, for the present, to these hints, a time will come, if they are made public,

when they will claim the investigation of some considerate mind. When that time comes, my object will be attained.

Experiment proposed.—To assist such well intentioned investigators, it may perhaps be proper for me here to state what I should conceive to be the most economical mode of consuming the produce of rich grass lands, that it may be subjected to the fair test of accurate experiments, conducted more at large than the circumstances of my farm permitted me to make.

If two fields can be found, of exactly the same extent and quality, the experiment can be fairly made, by stocking the one with cattle, allowing them to pasture upon it, and reserving the other to be cut and given to cattle of the same kind, by hand, properly kept in the house; the difference of the profit drawn from each class of beasts, will thus ascertain the comparative value of the two modes of management.

I need scarcely observe, that in order to make the experiment fairly, the two fields should be as much alike in all respects as possible; and, in particular, that the surface of the land intended to be cut should be smooth and even, so as to admit of being rolled frequently: for which purpose, the flatter the ground is in general the better.

Let the field that is to be cut be carefully shut up from cattle, especially during wet weather; and let it be rolled with a weighty roller in the spring, as soon as it is firm enough to bear the tread of the beasts without hurting the surface, first in one direction, and then in the direction across it. If it be twice rolled in that manner, it will be an advantage rather than a detriment, for it is of the utmost consequence, under the mode of management proposed, that the scythe should cut very close, without taking up any earth: one quarter of an inch at the bottom is as much as a whole inch at the top; so that, on account of the quantity of grass

to be obtained, closs cutting is of the greatest use. It tends, also, greatly to promote the quick springing up of the succeeding crop, as I have often observed; and by this practice, no dead leaves are left, which is unavoidable in rough cutting. Frequent rolling, with a weighty roller, while the ground is a little soft, is absolutely necessary for this purpose; and is also of use on other accounts, as will afterwards be noticed.

The field should begin to be cut when the longest piles of grass on it have attained the height of two inches at most, and proceed regularly, day by day, cutting as fast as the beasts consume it, so as to go over the whole in three or four weeks, as the weather is warm or cold; when that which was first cut will be ready to be cut a second time; and so on, never omitting to roll it when the weather is moist, and not too wet. The grass should be carried off in a light sparred or wicker cart, drawn by one small horse; this cart to move upon three low

wheels, placed two on one axle, and one on another, below the body of the cart, so as to act as a roller when going over the ground: a cart or rather barrow, of this construction, I had made, and found it a most convenient implement. In this manner the work will proceed regularly, and without trouble, throughout the whole season: The beasts should be regularly fed; getting only a small quantity at a time, but frequently, fresh and fresh; giving them sweet water when necessary, and as much grass as they will eat, allowing them proper time for rest. Nothing should be left in their stalls, at these times, to be breathed upon, and thus rendered disgustful to them; and if the house be so constructed as that the beasts can be easily kept cool to a proper degree, quiet and clean, they will thrive abundantly.

From the result of this experiment, when fairly made, and often enough repeated, so as to guard against the effects of accidental unobserved peculiarities, many corollaries may be drawn, that will

be found to be of high importance, in regard to rural economics.

In making this experiment, however, the full result of it cannot be clearly perceived, unless it shall be continued for several years: for, in the course of time, many important changes may be expected to follow, both in regard to the quantum of the produce of the two fields kept under these two modes of management, as in regard to its qualities. The experiment of one year can do little more than ascertain what is the result while the produce is nearly of the same quantity and kind; but as changes in both these respects may be expected, the comparison between the real benefits to be derived from one or the other mode of management, might be very fallacious, were it not continued for several years.

Grass lands, if constantly cut, are not deteriorated.—What the changes would be, both in regard to the quantity and the nature of the produce from the same field, if an-

nually cut, and the produce carried off, as above mentioned, or if consumed by suffering beasts to pasture upon it, cannot at present be told with certainty; but there are not wanting facts that may enable us to have some idea of the probable result.

It has been rendered probable, at least, from facts already stated in this essay, that dung, when dropped upon land by cattle pasturing upon it, does not tend to enrich it perhaps at all; or if it does so, it is only to a very small degree.

Whether rich grass land, if constantly cut, and the produce carried off from it, will thus, in time, come to produce crops less abundant than the same land would have done, if kept under pasturage, will not, with many persons, seem to admit a doubt: Yet there are considerations which so strongly operate upon my mind for doubting if this be the case, that nothing short of actual experiment can remove those doubts. I have often seen lawns around gentlemen's houses that

have been under a course of continued shaving for time immemorial, that discovered no symptoms of exhaustion, nor any sensible diminution of luxuriance or of verdure, though no manures of any sort had ever been laid upon them. This fact struck me as an important one ; and that I might not be mistaken with regard to it, I applied, for information respecting this particular, to a gardener who had had charge of very extensive lawns of this sort, belonging to a gentleman of large property : He assured me, that for the space of upwards of thirty years, that he had had the care of these lawns, some parts of them which had been laid down long before he knew them, and were originally, as he supposed, of a rich quality, had never received, during all that time, the smallest quantity of manure of any sort ; and that the lawn continued to be equally close in the pile, equally verdant at all seasons in the year, and required to be as often cut as ever ; and that, in short, he had no reason to apprehend that the quantity of its

produce had diminished in the smallest degree. This seems to me a strong presumptive proof that grass land, when once of a rich quality, may be continued for an indefinite length of time under the scythe, without being at all deteriorated, even where it gets no return of dung that is annually made from the produce of it. And as we have already seen that rich grass land, under pasturage, produces as much dung as ought to manure each year more than double its own extent of surface; it follows, that if the same quantity of grass land will only nourish as many beasts in the house, as if it were pastured upon, (and there are strong reasons for thinking it will do much more,) there can be annually obtained from each acre of land kept under the scythe, as much dung as might manure two acres more, which might be abstracted from that grass land without deteriorating it. Of course, if the land be such as that it can admit of being made richer, a dressing of that dung, now and then returned upon itself, would

give it the richness wanted, without any extraneous aid. In this point of view, then, it seems to be impossible to deny, that rich land, if kept under the scythe, can never become poorer, if none of the dung made by the beasts fed upon it be abstracted from it; but that, on the contrary, it can thus be made to afford a large annual supply of dung for the purpose of enriching poorer land, while it still continues to be equally fertile itself.

In regard to the other effects of the practice recommended, there seems to be no doubt that the *quality* of the grass must continue to improve while under the scythe, much more than while under pasturage. Every person, who has bestowed the smallest attention to objects of this sort, must have remarked that the worst kinds of grasses grow most freely upon those parts of rich grass lands that are the most open and spongy in their texture; and that they are in general much sweetened in the pile, where they chance to be much trod upon. Hence the finest

grasses, on such fields, are always found to abound most upon those paths which are moderately trod upon; white clover and the sweetest grasses being seen there in abundance, while they are less frequent in the spongy parts of the field. But frequent rolling tends to produce this effect more universally and equally, than any kind of treading by beasts (a practice frequently recommended by the best farmers,) ever can do.

Again.—It has been frequently remarked, by intelligent farmers, that the hard stocking of land tends much to improve the quality of the pastures, as well as its quantity. On this subject, as well as many others, the observations of Mr Davies of Longleat, in his account of the Agriculture of Wiltshire, deserve to be particularly adverted to. He observes, p. 18. that “ the sweetness of the feed depends
“ much more on its being kept close, and
“ *eaten as fast as it shoots*, than on any peculiar good quality of the grass itself: for
“ there are many downs that, when close

“ fed, appear to be a very sweet pasture
“ but which, if suffered to run a year or
“ two without a full stock on them, will
“ become so coarse, that sheep *will almost*
“ *as soon starve as eat the grass* : and even
“ in those parts of the downs, where the
“ finer and sweeter grasses abound, the
“ soil is frequently so loose and porous,
“ that nothing but constant treading will
“ prevent them from dying out, or being
“ choaked by the larger and coarser grasses.” And again, p. 23: “ They also
“ say, that this new kind of sheep being
“ so much nicer in their food, and rejecting the feed of the downs, on which
“ the chief dependance for sheep food is,
“ have suffered the herbage to grow gradually coarser and coarser ; and that
“ the farmers, in attempting to remedy
“ this evil, by shortening their stock of
“ sheep, have made it worse ; it being a
“ well known fact, that *the closer the downs*
“ *are fed, the more stock they will keep.*” He farther remarks, that in consequence of too light stocking, heath, in some cases,

comes in the place of the better grasses. But it is very evident that all the purposes of hard stocking, that is, keeping the grass short, and in a continual state of vegetation, and consequently sweet, and preventing the coarser grasses from running up to stalk and overpowering the others, together with the consolidating of the ground by treading, would be obtained with much greater certainty by the practice of mowing; while the animals that consumed the produce could in no case be subjected to a stint of food, which they necessarily must sometimes be, where reliance is had upon hard stocking alone for preventing this evil.

From these considerations, there seems to be good reason to believe, that not only would an equal quantity of produce go farther, if cut and given green to beasts in the house, than if it were pastured upon, but that, by a continuation of this practice for years, the ground kept under the scythe would gradually improve, so as to produce a greater quantity of food:

and that also of a richer quality, than if it had been kept under a course of pasturage; while, at the same time, a great quantity of dung might thus be acquired for the purpose of fertilizing other soils of a poorer quality. The reader, however, will please never to forget, that though this reasoning be very *probable*, it amounts not as yet to a *certainty*; nor can it ever do so, until some decisive experiments shall be made to ascertain with precision the facts that are as yet but imperfectly known.

Sweetness of pastures, what.—The term, *sweetness of pastures*, used above, and sweet kinds of grass, frequently occur in agricultural writings: yet it is doubtful if ever they have been properly defined, so as to convey a precise and accurate meaning to the reader, or been so much adverted to as their importance deserves. I shall here attempt to supply these defects.

Those pastures which animals choose to feed upon, in preference to others, and

which in general are eat down close to the ground, are said to be *sweet* pastures, in contradistinction from those where the grass, being disrelished, is suffered to grow to a greater length, and often to wither in part, without being touched, which are called *coarse*, or, if tending to dampness, *four* pastures.

Without entering here into a disquisition concerning the circumstances that tend to produce this sweetness of pasturage, which are various, I shall only observe, that from whatever cause it originates, it is, in as far as I know, an universal rule, that in every case the younger the grass is, the sweeter and more palatable it will be to beasts of every sort; and that the same weight of food will go much farther in nourishing or fattening an animal, if it be very pleasing to the palate of the animal to which it is given, than if it had been less toothsome. As this is a fact that has not been so much adverted to as it deserves, it requires to be here particularly investigated.

It is here necessary to advert, that a certain quantity of food is required for the mere sustenance of every animal, and if that quantity be daily administered to it, and no more, the creature will barely subsist, and neither grow better nor worse, if fattening alone is considered; and of course will never return, in the way of fattening, any profit to the farmer for that portion of its food, however long it may be continued upon it. But if the beast shall get a greater quantity of food than this portion which is barely necessary for subsistence, that surplus food then goes to augment the size, and to *fatten* the animal, and of course yields a profit to the farmer, in proportion to its quantity.

If this fact be admitted, it will necessarily follow, that the greater the proportion of this surplus food the creature can be induced to eat, in a given time, the more quickly it will be fattened, and, of course, the greater will be the profit of the farmer. For example,—If it be supposed that ten pounds of forage be the

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exact quantity of food required each day for the *sustenance* of the animal, there would be consumed by it, in the course of one year, 3650 pounds of food, without any profit at all as a fattening beast.

If, again, it be supposed, that by the addition of one pound of food each day, the animal got so much forward, as in the course of one year to be worth twenty shillings of advanced price, the account would stand thus :

Case first.

		lb.
For sustenance for 365 days	—	3650
For fattening 365 days at 1 lb.	—	365
In all	—	4015

Case second.

But if the beast were allowed two pounds extra each day, it would consume 365 pounds, (which, in this case, we are to suppose will *fatten* the beast as much as in the former case,) in six months, or $182\frac{1}{2}$ days, say 182. The account would, in this case, stand thus :

For sustenance 182 days at 10 lb.		1820
For fattening	—	365
In all	—	2185

Case third.

lb.

If the beast be allowed *four* pounds extra each day, it would consume 365 lb. in three months, or 92 days. The account would in this case be

For sustenance 92 days at 10 lb.	—	920	
For fattening	—	365	
	In all	—	1285

Case fourth.

If the beast could be induced to eat 8 lb. extra *per* day, it would consume 365 lb. in six weeks, or 46 days, in which case the account would stand thus :

For sustenance 46 days at 10 lb.	—	460	
For fattening	—	365	
	In all	—	825

From hence, it appears, that if the beast were fattened in the following periods, it would consume

If fed for one year	—	4015	
If half a year	—	2185	
So that the saving in this case will be	—		830
If fed for three months, it would consume only	—	1285	
Which deducted from	—	4015	
Gives a saving of	—		2730
If fed for six weeks, it would consume		825	
Which deducted from	—	4015	
Gives a saving of	—		3190

So that the same quantity of food, which would sustain no more than *one* beast, if

it were so sparingly administered as to require a whole year to fatten it, would be more than sufficient to fatten *four*, if they could be induced to take it in such quantity as to fatten in six weeks only.

But as it is hunger alone that can induce any animal to eat such kinds of food as are unpalatable to that creature, it is impossible to get the animal to eat more of coarse unpalatable kinds of grass, than what is necessary for bare subsistence only; so that such fields must be appropriated to breeding only, because, in the way of feeding, they can return no profit whatever to the farmer, by a kind of stock which disrelishes that food. If it be a little sweeter, they may get on a little; but the profit, in this case, will be very small. Render the grass more sweet and palatable, they will fatten the more quickly, and the farmer's profit be thus augmented: and so on almost in a geometrical *ratio*, in proportion to its augmented sweetness. Under this point of view, whatever tends to render the produce of fields more

sweet and palatable to the animals which feed upon it, is a very great national improvement; because it answers the same purpose that a large augmentation in the quantity of the produce would do. But if the *quality* can be improved at the same time that the *quantity* can be augmented, it will be a twofold gain, and the greatest national benefit will thus be obtained. But as it has been already shown that every kind of grass will be rendered as palatable as it is possible to be, by being cut and given to them in the house, while the quantity of its produce will, at the same time, be thereby augmented, it seems to be impossible to doubt that the practice must be highly economical.

Allow me here to point out one other obvious inference from the reasoning above, that has been hitherto but too little adverted to. It is well known that very rich land in general produces the sweetest pile of grass; and that calcareous manures, in particular, have been remarked

as being peculiarly calculated for producing this effect : It hence follows, that it is the best economy to lay lands down to grass while they are still in the most fertile state, before they have been exhausted by frequent corn crops, especially after liming. Land may certainly be made too rich for corn crops ; but I do not know if that can be the case with grass land, under a proper management.

I cannot too often warn the reader to take notice that the foregoing, and every other *illustrative* calculation, that occurs in these essays, is not to be considered as accurate in regard to the *quantum*, but merely in respect to the tendency : for I am by no means in possession as yet of facts upon which *accurate* calculations, in regard to the precise degree of profit or loss, in cases of this kind, could be determined. I know of no fact that has been yet brought forward, which clearly ascertains whether the degree of melioration is exactly in proportion to the *surplus* food of any sort that an animal can be brought to eat in

a given time, though the probabilities are greatly on that side.

Neither do I know if it be an universal rule, when animals *of different kinds* are compared with each other, that those kinds which can be made to eat in a given time the greatest quantity of food, can be the soonest fattened. The subject has never as yet, that I know of, been adverted to.

Under this head it deserves to be remarked, that when horses and cattle are fed upon the same kind of grass, it is universally admitted that the horse, if of the same weight, consumes more grass in a given time than the ox; and it is also a certain fact that the horse will become fat in much less time than the ox. It is generally, I think, allowed that a horse, living upon rich pasture, may be made as fat in one month, as a bullock upon the same pasture could be made in three. What is the exact proportion of food that would be consumed by these creatures, in the same space of time, has not, as yet, that

I know of, been accurately ascertained : but the general estimate that has been made, from the experience of former times, is, that two horses consume as much food as three cows or bullocks in the same time ; and they are so paid for in pasture fields, where they are both taken in upon time : If both these facts are so, it would appear that a horse could be fatted on less food than an ox. For,

Three oxen at 12 lb. would consume 36 lb. each day ; which, in 93 days amounts to 3348 lb. that is, for each ox 1116 lb ; and two horses, consuming also 36 lb. a-day, will eat in 31 days 1116 lb, which is at the rate of 558 lb. consumed on the fattening of each horse. So that, on these data, the horse can be fatted with precisely one half the quantity of food that the ox can. If this be so, the saving to the nation would be great indeed, were we at liberty to fatten horses for food to man, instead of cattle : but prejudice says that this must not be done.

I have often thought that no one prejudice which has ever prevailed in Europe, is so unreasonable, or can be so little accounted for, as that of refusing to eat the flesh of horses. It is not forbidden by the law of Moses, to which origin we can trace many of our vulgar prejudices: the animal itself is a beautiful clean feeding creature, so that no aversion can be excited on that account: its flesh, wherever it is eaten, in common with that of bullocks, is invariably accounted the greater delicacy of the two; and there are not wanting persons in this country who have tasted it, and concur in the same opinion. The prejudice, then, must be accounted highly unreasonable; and why should it not be overcome? Many persons among ourselves have got over the much better founded prejudice they had once entertained against eating swine's flesh, and now relish it perfectly well. The common people, at this moment, shudder at the idea of eating a frog; yet many persons in the polite circle have overcome that

prejudice, and admit it to their tables as one of the greatest delicacies : and what is to hinder them from overcoming in like manner their prejudice against horse flesh ? We have seen above, that it might prove a mean of reducing the price of meat, and augmenting the produce of the country : I shall only add, that humanity would strongly plead in behalf of this exertion : for were the flesh of horses to be eaten, instead of being worked to death, as they now are, and subjected to a treatment that outrages the feelings of nature, they would be put up to be fed ; kindly treated and pampered with delicacies, so as to have the full enjoyment of life till the last moment they are suffered to exist.

That some particular kinds of food have a greater tendency to produce fat than others, there seems to be little doubt ; and that others prove more nutritive for a given quantity, is undeniable. But the comparative value, in these respects, is in every case as yet unascertained ; so that here a wide field of investigation

remains that is wholly unexplored, which must be done before we can pretend to have attained any thing like a proper system of economy; but even a beginning, however feeble, is some faint advance in an unexplored region.

Condiments their importance on domestic economy.—On adverting to what has been said above, it will appear that too little attention has hitherto been bestowed to the subject of condiments as affecting animals. Hitherto the greatest part of mankind seem to forget that mere animals have the sense of tasting in as great perfection as man; and are disposed to indulge their appetite for sensual gratifications, without any restraint, wherever circumstances put it in their power. The uses that may be made by man, for his own emolument, of this natural propensity of animals, are very obvious when adverted to. Yet I know no case in which the general attention of men seems to have been strongly turned to that point,

unless it be in respect to the fattening of calves : for I have met with few persons who have had an extensive practice in this department, who are not sensible that the profit is in proportion to the quantity of milk that the creatures can be induced voluntarily to take in a given time. This solitary fact is known by thousands, who never once think of extending it to any other case of animal existence. But there are not wanting a few persons, who, in consequence of accurate observation, have discovered the vast importance of studying with care the taste of the creatures they feed, that they may not only furnish them with the kinds of food they like best, but also to vary these from time to time, and to give them exactly in the quantities, and in the way that they find will induce the creatures to eat the most ; having the full experience that the profit to be drawn from feeding beasts is always proportioned to the increased quantity of food they can get each individual *coaxed* to consume in a given

time. The cramming of poultry is another instance of the economy that arises from the principle here alluded to being adhered to even by *force* *. In this branch of rural economics, I have met with no

* The following method of fattening geese, in Languedoc in France, deserves to be generally known, as it will give some hints that may be useful in fattening other animals.

"After the bird has got into *full flesh*, (i. e. by being well kept upon green food,) it is necessary not to delay the fattening of them too long, lest you lose the season entirely. About the end of December they enter into rut, *after which time they will not fatten at all*. As soon as the frost has set in (usually towards the end of November,) they are shut up, to the number of *ten or twelve*, (never more) in a dark still place, where they can neither see light, nor hear the cries of those which are kept for laying. They remain in that prison till they have attained the greatest degree of fatness, and are ready for killing: that moment must be seized, otherwise they would very soon turn lean, and at last die.

"There are two ways of fattening them. The *first* is, by giving them a trough filled with grain which they call *farde*, so that they may eat whenever they please." The geese fattened on this grain are very delicate. Others put into the trough grains of maize boiled in water. They take care to give them *plenty* of that food, and *to keep the coop clean*. At the end of two or three weeks, the geese

person who has made greater progress than a plain practical farmer at Hope, in

are all fully fattened. They are then taken out of the coop, and allowed to go at large into the water for twenty four hours. Without that precaution, their flesh would have a disagreeable flavour †."

The above may be called the natural method of fattening, by *enticing* them to eat food enough of their own accord. The *second* may be called the *artificial* method, and is as follows.

"The geese are put up in the same manner as before, and are *crammed* twice a day, by putting into their craws by means of a tinned tube, as much as it will hold, of maize boiled in water. The tube is used, because the bill of the goose being furnished with teeth, the person who should attempt to perform that operation by hand, would soon have them scratched and torn to pieces. By this means, the geese acquire a *prodigious fatness*, so that a pair sometimes weigh from fifty to sixty pounds. Their liver weighs from one pound to a pound and a half,—is white and delicate;—but has a slight bitterness to the taste, which the liver of a duck has not. The *bearts* are large like a small apple, and when dressed on the grid-iron, they are excellent eating. The feet are boiled, after which they are fried the same as the tongue."

Ducks are fattened in the same place as under.

"When the ducks are pretty fat by the usual modes of feeding, they are shut up eight by eight in a dark place.

† I do not know what kind of grain is denoted by that of *farde*. It does not seem, from what follows, that the effect of the operation called *malting* on grain, intended to feed animals, is there known.

the neighbourhood of Manchester, who spares no trouble nor expence in procur-

Every morning and evening, a servant puts their wings across, and placing them between his knees, opens their bill with his left hand, and with his right fills the craw with boiled maize: they sometimes die suffocated; but they are not a bit the worse for it, provided care is taken to bleed them directly. These unfortunate animals pass there fifteen days in a state of oppression and suffocation, which makes their liver grow large, and keeps them always panting, and almost without breathing. When the tail of the duck spreads out like a fan, they know that it is fat enough; they are then turned out to bathe in water, after which they are killed.

"I have opened two ducks, of which the one had not, and the other had been crammed. The first had a liver of the natural size, the skin equally thick in all places, and the lungs perfectly sound. That which had been crammed, had an enormous liver, which, covering all the lower part of the belly, extended as far as the anus. (The ducks are generally suffocated when, by the pressure of the liver, the anus is opened, and the liver appears at its orifice.) The lungs were small, and loaded with blood. The skin of the belly, which covered the liver, was of the thickness of a shilling. When the ducks thus crammed, as well as the geese, have been plucked, they seem balls of fat, and none of their members are discernible."

There are some inferences not a little curious may be drawn from these facts, in regard to the fattening of other animals. Not only does it confirm the general posi-

ing such kinds of food and condiments as he finds best calculated to induce his

tion assumed in the text, that the more food an animal can be made to take, in a given time, the quicker it will be fattened: but this rule seems to hold, when it is given even in a *buriful* quantity, beyond what the animal would naturally have taken; and farther, that by certain modes of feeding, when well understood, the size of particular parts of the body can be augmented at pleasure, far beyond their natural proportions. Could the quantity of tallow in quadrupeds be augmented nearly in the same proportion to the liver, in this case, it is evident the profit to the owner would be greatly augmented. The following mode of fattening poultry, as practised by an experienced person in Britain, approaches nearer to that *natural* mode of feeding recommended in the text, and concurs in confirming the general doctrine.

Receipt for feeding poultry.

“Very short time is necessary. If a chicken is not fat in a *week*, it is distempered.

“Poultry should be fattened in coops kept *very clean*. They should be furnished with gravel, *but with no water*. Their only food barley meal, mixed so thin with water as to serve them for drink. Their thirst makes them eat more than they would, in order to extract the water that is among their food. This should not be put in troughs, but laid upon a board, *which should be clean washed every time fresh food is put upon it*. It is foul and heated water which is the sole cause of the pip. The preventive is obvious.”

cows to consume, in a given time, the greatest quantity of food possible. The consequence is, that this man makes much money, where his neighbours, who are not in the secret, and more niggard in their outlay than he is, sustain a loss. Among other condiments, this man has discovered that *pure* water stands pretty high in the scale; on which account his beasts are never suffered, far less obliged, to taste a drop of water that has ever been sullied by any animal setting a foot into it. With this view, they are always served with running water, which is, for their convenience, received into a long wooden trough, through which it passes while they are drinking. Such poor beasts, as are compelled, through necessity, to drink out of those muddy stagnant pools, in which other cattle have waded for days together to cool themselves in hot weather, which are fully impregnated with their dung and piss, feel the inconvenience of this nauseating draught; and the farmer of course suffers an abatement of his profit to an

astonishing degree. Astonishing to him, it may be justly called : for though he feels the effect, he seems to be ignorant of the cause, and therefore suffers it to exist, without an attempt to remove it, as every attentive person must have observed in many thousand cases.

Common salt, value of in feeding beasts.—
There is no substance yet known which is so much relished by the whole order of *gramenivorous* animals, as common salt. The wild creatures of the desert are so fond of it, that wherever they discover a bank of earth impregnated with a small proportion of salt, they come to it ever after regularly to lick the saline earth, as they would to a pool of water for drink, were there none other near ; so that when a hunter in America discovers such a lick, as such places are there called, he reckons himself sure of obtaining plenty of game, by lying in wait near it, and shooting them as they approach it, until the whole beasts that have discovered it are killed.

It is also admitted by all those who have tried they experiment, that salt, given along with the food of domestic animals *, tends very much to promote their health and accelerate their feeding; and although some persons, who have been at a loss to account for the manner in which this stimulant could act as a nutritious substance, have affected to disregard this fact, yet no one has been able to bring the slightest shew of evidence to invalidate the strong proofs that have been adduced in support of it; though, unfortunately for this country, few experiments of this kind have been tried in it. In fact, we have no reason to suppose that salt acts in the smallest degree as a nutritious substance, or, *of itself*, tends to fatten any animal; but that merely, by acting as a condiment, it whets the appetite, and gives the creature to which it is properly administered, a strong relish for its proper food, so as to induce it to eat a greater quantity than it would have done *in a given time*, and

* Except fowls, to which salt is a certain poison.

thus greatly to augment, as has been above explained, its feeding quality beyond what it otherwise could have had. In this way, it is not perhaps an extravagant position to say, that by a proper use of common salt, the same quantity of forage might, on many occasions, be made to go twice as far as it could have gone in feeding animals, had the salt been withheld from them. If so, (and let those, who are inclined to withhold their assent to this position, prove, by a set of experiments fairly conducted, that it is erroneous; till then, the unvarying testimony of the few who have tried it, confirming the position, ought to be relied on. If so, then I still say,) we have here laid open to our view an easy mode of augmenting the produce of our fields to an amazing extent: for if the same quantity of forage can be made to go, not twice as far, but *one twentieth* part only farther than it now does, it would be the same thing as adding one twentieth part to the aggregate produce of meat for beasts, throughout

the whole kingdom. But, according to the estimate of the President of the Board of Agriculture, there are upwards of fifty millions of acres of *cultivated* land in this island; the value of the forage produced by which cannot, on an average, be rated so low as twenty shillings *per* acre; but even at that low rate, the addition of onetwentieth would amount to 2,550,000*l.* *per annum*; a sum so great, that when viewed in the aggregate, it is difficult to bring the mind to believe that such an improvement is actually practicable; yet, when the particulars are considered in detail, it seems to be impossible not to admit that the amount of the improvement must be greatly above what is here stated*.

* The duty on salt is in a peculiar manner to be regretted in Britain; because it enchances the price of this necessary article to a much higher degree than would be experienced in other countries where no salt mines are found. Were it not for this tax, rock salt, without any purification, would answer perfectly well for the use of beasts, and could be afforded to farmers at perhaps one twentieth part of the price of salt at present; but we all know that rock salt dares not be sold in Britain.

Again.—

This improvement, however, *immense* as it must appear to be, in whatever way it can be viewed, is prevented entirely from taking place in this island, by reason of the salt laws: for while these shall be continued on the footing they now stand, it is vain to think ever to induce farmers even to try the experiments that are necessary for elucidating the facts here wanted: and other persons are, for obvious reasons, incapable of making the experiments; nor, if they could make them with the utmost accuracy, could they ever convince farmers in general so far as

Again.—Were the duty on salt taken off, it would be easy to show how the manufacture of salt could be carried on in Britain to an extent that scarcely knows any bound, *without the waste of one particle of fuel*, so as to admit of being sold to foreign nations at a much lower price than it can be had for from any other place; while it could also be made of a finer quality than is yet known any where on the globe. Thus would be established an immense trade in salt; which, as a necessary article, could admit of few interruptions; for no other nation is so circumstanced as to have it in their power to become our rivals in this manufacture. It is foreign to my purpose here to state farther particulars, but I pledge myself to do it, if ever properly called upon for that purpose.

to induce them to make a copious use of salt for their beasts in their general practice, while the duties shall be allowed to continue as they now are. Considered under this point of view, as well as many others, the duty on salt must be accounted one of the most impolitic taxes that ever was imposed in any country, as it tends to retard the prosperity of the nation, in a thousand ways, to an amount that no person who has not considered the subject with the same attention I have done, could ever believe to be possible. Better were it for the inhabitants of this country to pay a hundred times the amount of the free produce of the duties on salt, if levied in any one of a variety of ways that might easily be suggested, which do not bind up the hands of industry as this does. But so long as party cabals shall occupy the minds of the leading men in the legislative and executive departments of government, to the exclusion of every object from their serious thoughts, that cannot be immediately

connected with them, it is in vain to think that observations which tend to promote merely useful measures, which might perhaps affect the interest, and tend to disgust some powerful supporters of either party, or their adherents, will ever command the attention of any party. I write then, at present, as in times past, without hope, and merely from a sense of duty. I am happy in being placed beyond the verge of the vortex of any party whatever, otherwise I also might perhaps have been induced, like others, to leave this subject untouched, as well as some others that in a similar manner retard the prosperity of the nation, and which are equally respected alike by those who are in power, and those who hope to be so.

Hay, best mode of obtaining it of a fine quality.—Hitherto I have treated only of green forage; but as in this climate, where grass does not continue to vegetate luxuriantly throughout the whole year, a provision must be made for winter-food

for beasts; and for this purpose, on grass farms, it becomes necessary, in all cases, to appropriate a proportion of the land for hay. It becomes, then, a consideration of some importance, to enquire in what way hay of the best quality can be obtained in the greatest quantity, and at the least expence that the nature of the case will admit of.

From the considerations above stated, it is evident that it is a matter of much greater consequence than has been generally imagined, to take care that the hay shall be of the very best quality possible; because one stone of hay, of an exceeding fine quality, may probably go as far in *feeding* beasts as four of an inferior quality will do. Indeed no hay, but that which is of the very best quality, will *fatten* beasts at all; and there are very few places in this island, where the farmers are at so much pains in making their hay, as to render it so good as to be fit for this purpose. So little attention is in general bestowed upon this subject, that few far-

mers have even an idea of the circumstances that chiefly tend either to improve the quality of their hay, or to make it worse. For the most part, all that seems to be aimed at, is, to get the grass as quickly dried as possible, so as that it may admit of being kept, when put up in a large mass together. And as grass, that is already withered before it be cut, can be more easily dried than that which is very green and succulent, it is too general a practice to allow it to advance too far before it be cut, in consequence of which the hay is rendered of a quality much inferior to what it might have been. Some light will be thrown on this branch of our subject, by the following facts stated by Mr Davies, in his account of Wiltshire.

“ The dairy farmers,” he observes “ in
“ North Wiltshire, and in particular the
“ graziers, are much more attentive to
“ the quality, than the quantity of their
“ hay. It has been already remarked,
“ that they make a point of haining up
“ their meadows as early as possible in

" autumn, and of course are able to mow
" early in the summer.

" It is not uncommon to see grafs
" mown, not only before it is in blossom,
" but even before it is *all in ear*; and to
" this it is owing that it is more common
" to fat cattle with *hay alone*, in North
" Wilts, than perhaps in any county in
" the kingdom.

" And by this the dairy men are able
" to keep up the milk of those cows that
" calve early, and from which calves are
" fattened, which would otherwise shrink
" before the springing of the grafs, and
" never recover. And the advantage they
" get by early after-grafs, and by the du-
" ration of that after-grafs to a late pe-
" riod in autumn, fully compensates for
" the loss of quantity in their hay crop."

These observations are judicious; but
they do not go as far as could be wished.
Nothing is said as to the mode adopted
for *winning* the hay *, on which its qua-

* I am afraid that the phrase, *winning* of hay, is provincial, and may not be generally understood. By *win-*

lity must always greatly depend. It is in general understood, that if hay can be made so as to retain some tinge of its green colour: it is better than if it were bleached white, or rotted: but precautions are seldom thought necessary to be adopted for guarding against the effects of scorching sun-shine, which, by too quickly exhaling its natural juices, renders it sticky, brittle, and unpalatable to a certain degree; and, what is of still more importance, the effects of rain, or even dew, if abundant, if they are suffered to fall upon the grass after it is cut, and before it be made into hay, are seldom adverted to; so that if dry weather comes soon to exhale that wet, while the grass lies spread out upon the ground, the farmer feels little anxiety about the consequences; though it is a

ning, I mean to denote the process of converting succulent herbage into a state of hay that can be kept in quantities. I intended to have made use of the word *drying*, in this case, but it did not express my meaning. Grass, when wetted by rain, may be dried so as not to feel wet, when it is by no means in the state of hay.

certain fact that no hay, which has been in the least wetted during the process of hay-making, can ever be made to have that sweet palatable taste it would have had without it. Nor did I ever see it fail that beasts, when allowed to choose between hay so made, and that which has been carefully guarded from moisture, ever hesitated to make choice of the last, or committed a mistake, even where I myself could not distinguish a perceptible difference. By precautions that I myself have adopted, and which are mentioned in the Essay on hay-making, in the first volume of these essays, this evil may be in a great measure obviated; but even under that process, the surface of the hay-cocks cannot be protected from dew or rain; so that if wet weather shall come on during the hay process, a very large proportion of the hay must sustain a damage that greatly diminishes its value. To guard against this inconvenience, and to obtain hay, in all cases, of the very best quality the circumstances will admit

of, the following process may be safely conjoined with the practice of cutting and feeding beasts with grass in the house, above recommended.

If the produce of grass land is to be cut, as above described, and used green, it will be proper in general, to reserve a part of it for hay : In this case the cutting for *grass* and for *hay* should be carried on together ; but with the following variations, depending on the uses it is to be applied to. That part of the grass which is intended to be used green, as it will suffer no damage by being cut when wet, must continue to be cut regularly each day as it is wanted, without regard to the weather ; whereas that part of it which is intended for hay, ought on no account to be cut while wet ; and therefore that part of the operation must be discontinued ; unless when the weather is dry and fine ; nor should it ever be cut either in the morning, or the evening, while dew is upon it. And as the hay, in the mode proposed, ought to be made

day by day, for a continuance, as the grass comes forward for the scythe, while the weather is in a proper state for it; and not at all one time, as in the usual mode of hay-making, the cutting both grass and hay from the same field may be very economically combined together. For this purpose the grass which is cut in the morning, while the dew may perhaps be upon it, and in the afternoon, ought to be appropriated to the beasts green; and that part of the grass only, which is cut from nine till two o'clock, while the weather is dry and fine, should be made into hay. If the mower begins to cut down for hay about nine o'clock in the morning, and goes on in that operation till one or two o'clock afternoon, and if the persons who are to put up the hay, begin to that operation about one, the grass will thus be allowed to lie between three and four hours in the swathe, exposed to the sun, which will exhale some part of its moisture, and deaden it enough for the purposes required, though it still re-

tains the whole of its nutritious juices without abatement.

After being allowed to lie thus long, it should be raked clean up, and carried off the field in the same cart that is employed for taking in the grass, and immediately put into the stack, so as that the whole grass that was cut that day, shall be put up before evening; and thus regularly each good day throughout the season.

But as grass, while in this green and succulent state, would not keep if put up by itself, care must be taken to provide some dry forage to mix with it. For this purpose nothing can be so proper as good dry hay; but for want of that, at the beginning, good straw may be very safely employed.*

* I once saved a great quantity of clover hay, being a late third cutting, when the season was too far advanced to admit of its being made in the usual way, by putting it up when new cut, thus intermixed with a large proportion of good straw. It kept perfectly well; and when cut down and given to the beasts, was relished by them better

To perform this operation properly, it will be necessary to erect a permanent roof for the hay-stack, supported by upright posts of a proper height. This practice will be highly economical in every sense; not only because it will save the waste of thatch each year, and the labour of putting it on and securing it upon the hay-stack, but also because it will save from damage a great proportion of hay, which is unavoidably wasted in consequence of the imperfection of that kind of temporary thatching. Nothing, I conceive, but inattention, or the aversion that landlords have to erect proper buildings, or the want of security to encourage farmers to do it, could ever have reconciled the nation to the idea of securing hay by the imperfect protection of a temporary roof. The only hay-stack, properly so called, I have ever yet seen with a

than any other hay I had, and was equally valuable, I am persuaded, for every purpose. This mode of saving a late crop of clover is by no means uncommon.

permanent roof, is belonging to J. B. Bayley Esq; at Hope near Manchester, which is one of many judicious improvements adopted by that public spirited gentleman.

Nor needs this roof cost the farmer almost any extra expence beyond what he must have laid out for his proper accommodation in other respects : for if the bottom of the hay stack be made to rest upon beams supported so far above the ground, as to admit of his domestic animals to stand under them, the same roof will answer both purposes at once, as is done at present with dwelling houses of several stages.

When the hay stack is to be made up, a wooden gangway of a few loose deals should be laid along from end to end of the whole stack, about six feet above the surface of the floor ; a platform on the same level for receiving the hay, should be connected with it. By means of this gangway, a thin stratum of dry hay should be first strewed lightly above the bottom

floor ; * and above that a stratum of grafs should be strewed in the same light manner without trampling upon it ; and so on over the whole length of the hay-stack. If the extent of this stack be properly proportioned to the quantity of hay to be daily cut, it may be so contrived as that no more than one (or perhaps occasionally two) very thin strata shall have occasion to be thus made in any one day. In which case the new cut grafs will be exposed to the sun and drying air, for the best part of one day more, before it be covered up, without danger of being damaged either by dew or rain, † Another stratum of hay and grafs being,

* It will be necessary, in all cases where cattle are put below this hay-stack, not only to have a floor, but also to have the beams lathed below and plaistered, not only for the purpose of preventing fire, but also for preserving the beams from rotting by the breath of the beasts.

† To render this kind of hay-stack perfectly compleat, the sides of it might be covered with open deals set shelving like a tanner's dry house, which would admit the air without sunshine, and totally exclude rain even during windy weather.

in the same manner, laid upon this next day, will prevent it from being ever afterwards exposed to the sun, and will at the same time press it gently down, but still so lightly as to allow the air to pass through it, and gradually exhale its moisture. Each successive addition will press that below it a little more firmly, so as to make it slowly to consolidate below in proportion as it dries. Thus will the whole of the native juices of the hay be retained in as great perfection as can be conceived possible, without danger of having it either musty, in any case, (for musty hay is always occasioned by extraneous wet,) or over heated: And I have not a doubt, that if hay were thus made by the intermixture of dried hay of the same sort with the fresh grass, but it would prove as nutritious and fattening for beasts, (perhaps more so *,) as the fresh grass would be, while the quantity obtained, from the

* No hay has yet been seen that is equally fattening as succulent grass. I believe hay thus made would be more so, because its native juices would be fully retained, and

same extent of land, would be greater than can be got by any mode of management hitherto adopted.

To render it practicable to strew the hay in this manner quite equally over the whole surface of the stack, the reader will easily perceive that the gangway must admit of being shifted more or less towards one or the other side, as occasion may require; and also, that when the hay rises so high as nearly to touch it, the platform shall admit of being raised a stage higher. This, he will easily perceive, can all be effected without inconvenience, by making the gangway of loose deals, to be supported by light moveable bars, running across the stack, the ends of which rest upon bars fixed to the uprights that support the roof, horizontally along the side of the

only its superfluous moisture be drawn off; and that this watery juice is rather hurtful, is proved by experience; for every grazier knows that, in a dry season, when that moisture is exhaled from the grass, his beasts fatten much faster than in a rainy season, when it continues fully succulent; although the herbage upon the field be, in this last case, far more abundant.

stack, at the height of six feet above each other. All this will be so plain, by one moment's reflection, as to require no farther illustration here.

When the hay rises so high as to touch the eaves of the roof, it may be allowed to subside for some weeks, during which time it will have sunk a good deal, so as to admit of more being put upon it; after which, being allowed to settle once more, it may receive a fresh addition; and so on till it be filled choak-full up to the roof; the last additions being introduced by the end, the person treading on the hay in the middle, and squeezing it lightly before him, when he comes to the end, and to fill up the whole of the triangular cavity of the roof as full as may be. As there can be here no pressure from above, there will be no danger of its not drying sufficiently: or, if it be a corn farm, the haystack may be allowed to settle till the corn harvest; and at that time, the vacuity at top may be filled up with corn instead of hay. This will be a great conveniency to

the farmer in a ticklish harvest : for as he will be able to put up the corn without pressing it close, and as there will be little pressure upon it in this situation, he will be able to inn his corn long before it could admit of it in any other situation *.

* It may perhaps be deemed a digression in this place, but I cannot omit the occasion that here offers, to take notice of the benefits that the farmer might derive from the practice, were it universally adopted, of putting up all his corns, as well as hay, under permanent roofs, constructed on the general plan of that recommended for the hay-stack. The expence would be trifling at first, and the saving afterwards very great, as well as the accommodation it would afford. It would in fact be only heightening the roofs of the houses he ought necessarily to have upon the farm, so as to admit of placing the corn above the beasts, and shades for utensils, &c. he must have at any rate ; for no walls would be necessary to that part where the corn is to be kept.

If this plan were to be adopted, it might be effected in the following manner. Let a row of posts be placed perpendicularly on each side of the building where the walls should be, at the distance of six feet from each other ; these posts resting below on the floor, and supporting at top the platform on which the couples for the roof are to stand, which will bind them firmly. Place then another row of perpendicular posts at six feet from each other across the building, directly from side to side, in a line be-

For the purpose of *fattening* beasts, it may be necessary to mix the *hay* with the

tween the two outside pillars. The top of these inner posts to be fastened to the girder, or, as it is called in Scotland, the *balk* that joins the under part of the couples; and the roof being put on and properly secured, the building is finished.

This structure being in readiness, and the corn supposed to be ripe before it is reaped, and dry cut down, it may be carried home the same day, and built up with safety in the following manner :

For every purpose, and in whatever way the corn has been reaped, I am satisfied it ought to be bound up into sheaves before it is led, if economy be aimed at; and the neater these sheaves are done up, the better: for the expediting the loading and unloading, and the saving the waste that would accrue by shaking, and while carrying it about loose in forking, will always do much more than pay for the expence of binding it up, even where the corn has been cut down by the scythe; (a slovenly practice, however, which cannot, I am satisfied, from actual experiment accurately made, be in any case advisable, where all *items* are fairly taken into the account.) Supposing it then to be in sheaves, begin to build it up in the corn shade, by laying a row of sheaves with the butt ends outwards, right across the shade in a line with one of the rows of posts; and another row of sheaves in the same manner, in a line with the next row of posts, laying the tops of the sheaves towards each other. These ought to be laid in by hand loosely, from a scaffold on

grafs, but for rearing young beasts, or other purposes, it will be highly economi-

each side, and not trod upon. The points of some of the sheaves will reach to the butts of the others, and they will pack thus quite well. A row of sheaves is then to be laid across these, so as that the length of the sheaf lies *across* the building. The butts of the sheaves of this row should be placed first on the outside, and then another row of sheaves should be placed, in the same direction, overlapping the points of the former, and so far from the side, as that the middle of the sheaves shall be opposite to the first post; and on the other side of it another row reversed, so as that the points of the one sheaf lie towards and intermix with the points of the others; and so on across the whole building, in rows, with the butt ends of one row of sheaves to the butt ends of another, leaving a small space between them for the circulation of the air. Above these should be laid another stratum of sheaves across these, in the same direction as the first; and so on, crossing each other in alternate layers, the whole way till it reaches the top.

One division, of six feet in width, being thus finished, another is to be begun, and finished in the same manner, leaving one of the intervals of six feet between the posts free, across the whole structure, and the other filled up alternately throughout the whole.

In this way, the work goes on from day to day, as the harvest advances. The corn is thus secured immediately, as soon as it is cut, from the possibility of receiving damage from bad weather; and being placed high in the open air, in narrow divisions, full of perforations, what sap is in it

cal to make use of straw for this purpose : for straw of oats or barley, when thus mix-

will be gently evaporated, while the native juices of the plant will be preserved, without danger of heating.

The sheaves being put up loosely, the stack will gradually subside a good deal in consequence of the pressure from above. And as it will be fit, in most cases, to be packed more closely after a few days, by the time that the whole range of shades are thus filled up, and room wanted for more corn to be put into it, the sheaves that are upon the top of the first division, and which are of course now the driest, ought to be thrown down into the first open division, and regularly laid and trampled upon, so as to make them firm ; until, by lowering the one division, and raising the other, they come to be of an equal height, when the operators should proceed to another, and so on gradually to others, as they are wanted.

The under part of the shade will now be filled close up, and the top be left quite open, as at first, so as to admit of a similar operation with the former, the first led corn forming now the base, and so on. The later cut corn may now be put upon the top of it, exactly after the same way with the first ; and being high in the air, and not so much pressed by the weight above, it will be more quickly dried. Thus should you proceed, making two or three successive rows, if necessary, until the harvest is finished, and all got in.

For wheat, which is much firmer in the straw than other corn, and generally cleaner and well ripened, less precaution is necessary. The first division may be put up

ed with grass, will be equally good as ordinary hay. If economy were duly stu-

as above described ; but it will not be necessary to leave any open divisions for this kind of corn : one division after another can be filled up from the scaffold at one side. In most cases, no precautions will be wanted to prevent it from heating ; but where it is greener cut than usual, and it appears doubtful if it will keep well, in laying the sheaves lengthways across the shade, an opening of a few inches in width may be left in the middle, between two sheaves, all along in the same line right across the whole, which being covered by the sheaves laid lengthwise across it, will admit a circulation of air : one of these pipes may be made in every second, fourth, or sixth layer, as circumstances shall seem to require.

After this manner, the whole corn of a farm could be perfectly secured against sustaining any damage from the weather in any season ; and thus an immense expence, on some occasions, and an amazing waste in others, be entirely prevented ; while the straw, in every case, would be nearly as good as hay ; and the quality of the grain much better than it ever can be, if subjected to rain after it has been reaped : For I have found by experiment, that if grain has ever been wetted from the time it is cut down, it never can be brought to the same state of perfection as it would have had, if it had never been wetted : nor can any art ever make the same corn, if it has been once wetted, shrink into so small a bulk, or become of course so weighty as the same corn would have been, if it had been thoroughly *winn*, without having been at all wetted. Nor

died by farmers, perhaps not one particle of these kinds of straw ought ever to be employed in any other way: nor could the possessor of *corn* farms ever be at a loss for making such an intermixture, as he will find it profitable always to have as much ground under clover, as would be sufficient thus to mix the whole of his straw, if he inclined. If the proportion of wheat straw were more than enough for litter, it may be cut and profitably applied in the same manner. But men must accustom themselves to regard economical considerations much more than they do at present, before they can bring their minds to bear with patience such disquisitions as the present. Till that time shall come, agriculture must stop far short of attainable perfection in Britain.

I wish to go on.—But the fear of becoming tiresome makes it necessary to curtail: yet I must add, that as so much

does barley, that has been wetted and afterwards dried, ever malt so kindly as it would have done, if kept quite dry. This is a fact I believe that is not generally known.

saving may arise from the proper distribution of buildings; and as this would become an object of much greater importance than it now is, were the system of stall-feeding in summer, as well as in winter, to become universal, a few words on that head may not be deemed superfluous.

On the right construction of farm-buildings.

—Whatever diminishes the quantity of labour required of one man, produces a saving to the farmer that will be in proportion to that diminution of labour. In houses ill arranged, and of course inconvenient, it will require one man to feed and clean from ten to twenty stall-fed cattle, but in houses properly constructed, I have known one man be able to feed and clean fifty head of beasts with great ease. The arrangement which admitted of this economy, was as under. The house was divided by a foot way of six feet wide, running along the middle from end to end. On each side of it was a range of

stalls for cattle, placed with their heads towards each other, of such a length as to admit of twenty-five to stand on a side, which, at three feet for each will give seventy five feet. At each end of this walk was a door, by one of which the hay or other dry food was introduced; and at the other turnips or other food recently brought home were laid down, so as not to mix with or foul the hay. Along each side of the walk was placed a wooden trough running the whole length without interruption, a section of which was of this shape,  the bottom being about six inches wide. Between each beast there was a small division by means of a board, perforated below, and the whole trough was placed in an exact horizontal position, the bottom being raised about six inches from the ground. Behind the troughs were placed the stakes to which the beasts were fastened. The floor on which they stood was paved; sloping a little backwards, and at a length just sufficient to allow the beasts to stand

easily and no more, it was lowered at once about 3 inches, so that the dung which was dropped from the beasts, when they stood right, fell into the lower division. This part of it, and indeed the whole, was made very smooth so as to admit of the dung being easily swept off by a broad mouthed flat shovel or rake occasionally, and put into a wheel-barrow as often as was necessary, and thus carried off. The upper part of the structure was supported by strong posts placed at proper distances, and a passage of three feet left clear behind the cattle. This house had been originally intended to be left open without walls; but as it was found to be too cold for winter-feeding, to which it was solely appropriated, the spaces between the pillars had been walled in. For a house to be used the whole year round, it would best answer the purposes of this climate to have these intervals closed in winter, by boards that join to each other quite close, which could be removed during the summer so as to keep the

cattle quite cool at that season. At one end of the stalls, where the situation will admit of it, should be a pipe of water, which could, by means of a stop cock, be let into the troughs at pleasure. In this way the whole troughs could be filled at pleasure with pure water; and when the beasts had drank as much as they inclined the water that remained could be let off by opening a plug in the bottom, and carried clear away by a channel prepared for that purpose. In feeding, the attendant fills a barrow properly constructed for that purpose, and wheels it along the middle walk, giving to each beast as he goes along, a small quantity only of that kind of food; and so on till he goes over the whole. As soon as that is eat up, (or if any part of it remains in the stall of a particular beast, he takes it first away :) he gives each beast in the same manner, another small quantity of a different kind of food. In this way he goes over them three or four times successively, varying the food at each time if he

can; and always reserving to the last the sweetest and most palatable kind of food by way of desert. Then sweep their troughs clean; and if they have got much dry food, especially if salt has been administered, the trough ought to be filled with water, at least four times a-day, which will keep it always sweet and clean, and induce them to eat much more than they otherwise would have done.

It is not consistent with the plan of this essay, to enter fully into the best mode of fattening beasts; or to specify the kinds of food which answer best to be conjoined with each other; or the way of varying them, so as to produce the most beneficial effects; or the mode of managing the beasts themselves, as to temperature, dressing, &c; or how to choose the food and apportion it to the different ages of the beasts, and circumstances of the case, &c. &c. This would form an ample subject for a separate dissertation. I may, however, here specify one singular fact, that refers immediately to the subject of this

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essay, which lays open a wide field of enquiry to the attentive farmer.

Noxious plants may be converted into nourishing food.—There are some of the products of our fields which are not only not useful, but highly noxious to the farmer; as, instead of nourishing his beasts, they prove actually poisonous to such beasts as accidentally taste them. The following fact will show, that had the enquiry above specified been duly made, some of these might be rendered highly nutritious.

No plant common in Britain is a more certain poison to domestic graminivorous quadrupeds than the common yew tree, (*Taxus Baccifera*;) and many are the instances of cattle, horses and sheep, being killed, which have accidentally tasted of its leaves and young twigs. Yet it is a very surprising fact, that in the province of Hesse in Germany, where hedges of this tree abound, the peasants are in the custom of feeding their cattle through the winter, with the tender shoots of that

tree, cut down from their hedges for that purpose, which they find a very excellent and nourishing food at a season of the year when other sorts of succulent food cannot be easily obtained.

This singular fact having come to the knowledge of Professor Wiborg, of Copenhagen, he at first was inclined to think that the common opinion, that the yew tree is a poison to animals, was unfounded : but experiments soon satisfied him to his cost, that it certainly was so. He then suspected that the tree called by that name in Hesse must be something else than the common yew ; and he determined to take a journey thither to ascertain this fact. He found it was the common yew tree ; and, by experiments he there made, he also found that it proved equally poisonous to beasts in Hesse as it had been in Denmark.

He then suspected that he had been misinformed in regard to its being there used as a food for beasts in winter. But here also he was soon satisfied he had been

told only the truth ; as the peasants readily allowed that they used it for that purpose every year, and that it made a valuable part of their winter provender.

Surprised at these facts, he then enquired what were the means they employed to destroy its noxious quality ; but to this they could give him no satisfactory answer. All they knew of the matter was, that they found it necessary, at the beginning of each season, to use it sparingly at first, and to give it along with their other food ; that they gradually encreased the proportion of yew twigs, which at last came to be a principal part of their food ; but that they never kept their beasts entirely on that food alone, but always gave them something else along with it.

At the first he suspected, that, in this case, as is experienced by man in regard to opium, the animal frame gradually became habituated to this drug, so as to admit of its being taken in much larger doses, in time, with safety, than could have been practicable at the beginning ; and willing

to make some experiments to ascertain this point, he tried to give it alone in smaller doses than those he had formerly administered, and found to be poisonous ; but the beasts he tried refused to eat it by itself in any quantities ; so that he began to suspect that the reason of their mixing it with other food, at the beginning, in very small quantities, was merely to cover its taste, which proved disagreeable, till the beasts came to be habituated to it, when they eat it more readily.

If so, it seemed to him probable, that its deleterious effects were counteracted merely by the operation of the other food that was administered along with it, upon the animal economy. Convinced of this, by the facts that had been stated to him, he ventured to give, at once, to a horse eight ounces of green yew twigs, (which he had repeatedly found before was a dose sufficient to kill any horse when given by itself,) chopped small, and mixed among twenty ounces of oats. This mix-

ture the horse readily eat up at the first; nor did the smallest symptoms of any disorder appear. This experiment he so often repeated, as fully to ascertain the fact, that when administered in this manner, the yew tree was perfectly innoxious; and it is solely to the circumstances of its being always administered along with some kind of dry food in Hesse, and never by itself, that it proves there salutary instead of hurtful.

He has not ascertained whether every kind of dry food for beasts would answer the purpose, or whether it is confined to some particular kinds only: but as the peasants have remarked no peculiarity in this respect, it is probable that any kind common in that country answers the purpose equally well as others. Neither is it ascertained as yet, what is the smallest proportion of such dry food that will barely serve to render it innoxious; but here, as in every case where accuracy is required, experiments are still wanting.

From this fact we ought to infer, that perhaps there is no plant whatever produced in this country, that may not be employed as food for beasts under a judicious management, though we are as yet ignorant of the way in which any other substances than those we have long been accustomed to use, can be employed with advantage by the farmer.

Sheep may be stall-fed.—Hitherto I have supposed that stall-feeding can only be employed with regard to beasts that have been usually kept in the house; viz. cattle, horses, and swine: but it will be presumed, that sheep must be thrown out of the list of domestic animals, if ever the mode of stall-feeding * on green food above recommended, should come into general practice. So far is this, however, from being the case, that I am inclined

* The phrase *stall-feeding*, has been hitherto applied chiefly to the *fattening* of animals. By that phrase, in the text, I mean to express merely the giving to them food in the house, for whatever purpose the beasts are kept.

to believe that if sheep should be fed after this manner, the improvement will be greater on them than any other class of animals. It is true, we have never yet been accustomed to see sheep fastened to a stake, and thus fed by hand, like what has been done with cattle ; but this only proves that we have not hitherto considered the subject with the attention it requires, and no more ; for I know of no instance where it ever has been tried and proved abortive. It behoves us then to enquire what reasons we have for believing that it would not succeed ; and if we can find none which tend to that point, but rather the reverse, we ought at least to suspend our ultimate decision on that point, until the fact shall be clearly ascertained by fair experiment.

We know that the sheep is an animal as gentle in its nature, and as susceptible of domestication and controul, as any creature whatever ; and therefore we have no reason to believe that it would make any violent struggle, or such efforts as might

tend to retard its thriving, if tied up; but much the reverse; for it delights in ease and quiet: so that in this state it would meet with an indulgence, in this respect, entirely suitable to its nature.

We farther know, that no domestic animal suffers so much from wet as the sheep: for, on account of the thickness of its fleece, it becomes so weighty, when wet, as to overload the poor creature, so as to oppress it. And as it is long before it can be dried, especially in winter, the animal is chilled by the cold while thus drenched in wet, so as greatly to retard its thriving. But if the sheep were put into a stall *when dry*, and never suffered to go from under cover to be wetted, it must be totally freed from both of those inconveniencies; in consequence of which it could not fail, as one would think, to thrive much better under this mode of management, than that to which it has hitherto been usually subjected.

It may perhaps be alledged, in answer to this, that we do not observe that sheep

thrive in general better in those districts, where they are usually put up under cover all night in cotts, than in those districts where they are never housed at all; but rather the reverse. I believe, indeed, that they always thrive worse where they are cotted, than where they are suffered always to lie without doors: but this seems not at all to militate against the practice recommended, because the cases differ from each other in an extreme degree. When put up into a cott, while the sheep are yet wet, as must often, indeed usually, be the case in winter, and there stowed very close together, as they usually are in these circumstances, they must soon become extremely hot, and a copious steam arise from their wet skins, under which they must be stewed for the greatest part of the night: but it is well known that the sheep delights rather in a cold than a hot climate; and if it be dry, this animal never seems to enjoy such perfect health as during the coldest weather we ever experience, provided it have at all times a-

bundant food. This kind of stewing heat thus produced can scarcely fail to prove highly detrimental to the creature; and when it is considered that the vapour that rises from its own dung, on which, to a great depth, it is usually obliged to lie in these cots, mixes plentifully with the warm aqueous vapour, it can scarcely fail but that diseases of various sorts will be the consequence. Nor is this all: after being stewed all night in this close place, and put into a state of high perspiration; the poor creature is turned out hungry in the morning, perhaps amidst frost and snow, which soon freezes the water in its fleece, stops all the pores in the skin, suddenly checks all perspiration, and chills the poor creature almost to death during the whole day. Under this kind of management it would be wonderful indeed if diseases innumerable were not to be the consequence. But where the creature is put up while dry, and is kept continually so, and at rest ever afterwards, in a cool airy place, where it never

can be so much crowded as to suffer any extraordinary degree of variation in regard to heat or cold, and at the same time receives abundance of nourishing food, none of these evils can be experienced ; and the diseases which originate from that source can never be expected to appear.

From these considerations, to omit others that might be mentioned, there seems to be good grounds for believing that sheep will admit of being stall-fed with perhaps greater benefit to the person who adopts that mode of management, than that which is to be drawn from any other animal whatever.

Those, then, who would wish to fatten sheep under the system recommended, in preference to other kinds of domestic animals, have no reason to think that they will be under a necessity of laying aside the scythe on that account. It will be easy to contrive low apartments under the hay-ricks, properly divided by stakes and alleys of a proper size, bounded by stakes, as for cattle, of a proportional size, to

which the sheep may be fastened, and thus to be regularly fed by hand throughout the season. Whenever the experiment shall be fairly made, it will soon be seen whether it will be attended with as much profit as we at present have reason to expect; and when this fact is ascertained, the practice may be either continued or abandoned. The person who shall try this experiment, can run no risk of sustaining much damage by it; and as the expence attending it can be but small, it seems to be a very proper object of experimental trial.

On the consumption of turnips by sheep.— Though those branches of the subject I meant to have treated in this essay be not nearly exhausted, I find the volume has swelled to such a size, that it becomes necessary to curtail a good deal. Turnips, however, are an article of such vast importance to the farmer, and the economical modes of consuming them have been so little adverted to, that I cannot omit

offering a few short hints on that head, before I conclude.

There are three modes in which turnips have been hitherto chiefly applied; viz. 1st, eating them by sheep on the field in which they grew; 2^d, drawing them, and giving them to cattle *in the house*; or, 3^d, drawing them, and giving them to beasts in the field *. To these practices I do not object; but there are some circumstances respecting the management of each, that do not seem as yet to have obtained all the attention they deserve.

In consuming turnips where they grew, by sheep, much waste is incurred over most parts in Britain, by letting them have access to too great a quantity at once. It is not uncommon to hurdle off as much ground at once, as is intended to keep the sheep for a week at least; and sometimes as much as will serve them four

* Sheep cannot conveniently be fed by *drawn* turnips; unless the turnips be of a very large size, otherwise they roll about so much, as not to admit of being scooped out by them. The fragments of turnips which have been left by cattle, are not liable to this objection,

weeks, without moving the hurdles. The sheep have thus at one time too much food, in consequence of which they range at once over the whole, and break, during the first day, almost every turnip in the field, all of which broken turnips begin instantly to rot, so that many of them become in a short while so putrid and stinking, that no creature will taste them, and a large proportion of wholesome food is thus inevitably wasted. Nor is this the only waste sustained by this practice. As the pulp of the turnip is more palatable to the sheep than the rind, they naturally scoop out the pulp from the whole, before they ever think of eating any more of the rind than is necessary to give them access to the pulp. When that pulp is all consumed, however, they must either eat the rind *alone*, or the whole of it will be lost; so that the farmer finds himself constrained either to keep his sheep so long upon that part of the turnips, as to compel them through hunger to eat the turnip peel, (in which case the creature must

cease to thrive, if not to fall back into a worse condition than before,) or he must resolve to abandon the turnip skins to waste also, although he knows that these, under proper management, are a very wholesome kind of food. A good economist will think it necessary to adopt such a mode of management, as to sustain no sort of waste under this head.

With this view, he will not blindly adopt the notion which seems to be but too common, that turnips can only be beneficially employed for *fattening* of sheep; but he will examine with attention, whether, under certain circumstances, he might not be more benefitted by *rearing* sheep by the aid of turnips, than by *fattening* them. Every considerate man knows that the market for fatted sheep is extremely limited, in many remote situations, which are peculiarly adapted for sheep rearing; but that if he can contrive to keep his breeding sheep always in high condition, he will find abundance of markets for these at good prices, where sheep

in worse order could not be sold at all. When turnips were first introduced into the remote parts of Britain, they were invariably considered as being in a manner exclusively adapted for the fattening of beasts; and that was the use to which they were solely applied; but, by degrees, experience taught the farmers in some remote situations, that a much greater profit could be derived from applying them to the sustaining of milk cows, and the rearing of young cattle, than to the feeding of them; and these are the uses to which this valuable article is now chiefly applied. But the use of turnips for keeping on a breeding stock of sheep, though it is known in some districts in Britain, is far less generally understood than it deserves to be. By this mode of applying turnips, however, it would seem to be a very easy matter for an attentive economist to avoid the waste above pointed out, and to derive the full benefit from all his turnips with much improvement to his flock.

All that is required for keeping a young flock in a constant state of growth through the whole year round, is to prevent them from being ever stinted for food, especially of the tender and succulent sort. It must happen, however, that during the winter, when the days are short, and the weather severe, very little succulent food of any kind can be found on their common pastures ; so that they are pinched for hunger, and greatly decline during that season, if they do not die entirely. What is wanted then, is a small addition to their ordinary food, administered so equally throughout the winter season, as to give them each day enough to prevent them from sliding, though not so much as to fatten them for the butcher. This will be best done by giving them a snap of turnips each night, that shall in quantity be just sufficient for this purpose, without being so much as to prevent them from seeking and relishing their ordinary food throughout the day. With this view, let us suppose that a row of hurdles is run

along one side of a field of turnips, so far only as is just sufficient to allow the whole flock to get access to the turnips with their heads at one time. Let this row of hurdles be moved just so far back every day, as to leave access to as many turnips as shall be judged sufficient for this purpose, and no more. The consequence will be, that when the sheep come in from their pastures at night, after having picked up as much through the day as they could there find, they will eat their turnips by way of dessert; and then lie down to repose during the night in a comfortable state, with their bellies full. If the food throughout the day has been scanty, the turnips will be all eaten up at night, skins and all. If the food has been more abundant, perhaps a few of the skins may be left till the morning, when they will be clean eaten up. In general, it will be advisable to set off rather fewer turnips at one time than the sheep could easily eat up, in order that none may be wasted. By this practice the sheep will be kept in per-

fect health and high condition, throughout the whole year, and will grow, nearly, as much during the winter as the summer months. The ewes in particular will be kept strong and healthy, so as to produce stout lambs, and afford milk in much greater quantities when they yeau, than they otherwise would have done; as is known to be invariably the case with cows that have been kept up by means of turnips during the winter; and being in high health in the spring, the whole flock will advance with the first spurt of early grass, so as to be at all seasons more forward for market, and consequently bring much higher prices than otherwise could have been the case.

By moving the hurdles regularly forward, as proposed, and leaving the field open behind them, the area in which the sheep are confined will become larger every day as the season advances, so as to give them better room to choose their bed where they find it most convenient. A necessary consequence of this will be,

that if the field be uneven in its surface, the sheep will naturally choose to lie most upon the high and dry patches, which are usually the poorest parts of the field, so that these patches will thus get a more than ordinary share of the dung, which is precisely what they stand in need of to make the crop equal over the whole. To admit of this it will be proper to begin in all cases at the higher parts of the field, and advance downward to the lowest extremity. But on this, and other particulars of management, equally obvious, it is unnecessary to enlarge.

I shall just hint, because it is not as yet universally known, that where the early grass yielded by watered meadows cannot be obtained, succulent food for keeping sheep on in the months of April or May, till others grass gets up, may always be procured merely by sowing or planting (this kind of turnip admits of being transplanted as easily as colworts,) a proportion of the turnip-field with the Swedish turnip, or *ruta бага*, which will

keep perfectly succulent till June, if so long wanted; as I myself have often experienced. This kind of turnip does not indeed grow to so large a size as the common sorts; but it is much more solid, and goes much farther, bulk for bulk, than any of them do. Its flower stems shoot out as early in the spring as those of other turnips; and they will become as soon sticky, if not adverted to. But where they are to be applied as above, the stems should be cut over before they become sticky, and given either to the sheep or cattle. New stems will shoot out in their stead, which will continue tender for a considerable time. In the mean while, the bulb loses none of its succulence, if it should be even allowed to ripen its seeds before it be used; only the skin becomes hard and sticky towards the month of June, at which advanced season it could scarcely be gnawed even by young sheep. But every one knows that after the beginning of May, there are very few situations in Britain, in which

grafs cannot be obtained in abundance for sustaining sheep, so that it is unnecessary to provide a supply from this plant in *any situation* beyond that period ; and in few situations can it be wanted, even so long as that time. It would be improper in me to say more on the culture (which differs in some respects from the common turnip,) of this plant, which is truly a valuable addition to the farmers catalogue of plants, where the uses of it are properly known.

My limits prevent me from entering on an examination of various other modes of applying turnips which have hitherto been little adverted to, particularly for dairy cows, which under a judicious management can be fed by them, without affecting the taste of the milk in the smallest degree, and of course requiring no process for removing that taste ; and for rearing young horses, to which use turnips can be applied with singular economy ; as well as for various other purposes, which the attentive economist will

discover when he directs his attention steadily to this subject.

CONCLUSION.

I SHALL not at present proceed farther in this disquisition, though there are many other particulars I did intend to have touched upon. But the volume is already of such a size, and the reader, I fear, so much tired of these (to many) uninteresting details, that I willingly desist from proceeding farther at present. If only a few persons shall be induced, in consequence of what has been said, to turn their attention to these subjects, who otherwise would not have done it, I shall be satisfied: but it would give me still more pleasure, if I could indulge the hope that, in consequence of these hints, the reader should be induced to think for himself in all cases; to reflect upon the objects he sees; to examine the foundation of po-

pular opinions, and then to draw his own conclusions from the whole. It is thus he will acquire sound knowledge, much better than by relying on the instructions he shall receive from any writer whatever: for there is no proposition in Euclid more certain, than that, in this way, every man may soon become the best, as well as the most pleasing, instructor of himself.

THE END OF ESSAY THIRD.

POSTSCRIPT.

Cursorfory remarks on the corn laws of Great Britain.

I INTENDED to have here made some remarks on the corn laws of Great Britain, and the caufes of the high price of grain, on which thefe laws have had a confiderable influence. With that view I omitted treating of them in the 14th Section of Effay Firft. But upon digefting my thoughts upon this fubject, I found that before I could elucidate the matter, fo as to make it be fully underftood, it could not be compreffed into a fize to admit of being brought within the compafs of the prefent volume ; fo that I have been forced to abandon the idea of it. This, indeed, becomes the lefs neceffary now, that the very interefting treatife on the corn laws by Mr Dirom, with the additions to it by Mr Mac-

kie, have been published *. For although the subject is there taken up under a somewhat different point of view from what I should have done, and several particulars that I consider as of great importance, have been in a great measure overlooked by these gentlemen; yet as the conclusions they draw nearly coincide, as far as they go, with my own, I am well pleased to abandon the subject for the present, hoping the public will bestow so much attention to the forcible arguments founded on undeniable facts brought forward by them, as to pave the way for the observations of other men who may at a future period push their investigations a little farther than they have, perhaps wisely, chosen to do on the present occasion.

Referring then to that treatise for reasons that will satisfy most men, I shall here, with a view not to leave the treatise incomplete in one of its most essential ar-

* Entitled an enquiry into the corn laws and corn trade of Great Britain, 4to. Nicol and Swell, London:

articles, barely state the conclusions I should have been forced to draw on this subject: viz. That the corn laws of Great Britain, as they at present stand, are extremely inadequate for the purposes intended by them: that the principle of them, if any consistent principle can be fairly recognised, is erroneous: that as they at present stand, they neither are, nor have been, nor can be executed: that they are calculated to give rise to jobs, chicanery, and frauds innumerable: that they unnecessarily interrupt the internal commerce of grain, so as to distress the people, and depress the agriculture of the nation: that under the pretext of attempting to lower the price of corn, they really enhance it beyond what it ought to have been, and give occasion for the interference of Government in innumerable cases, where that interference can only prove hurtful to the public at large, with some other evils, which it would be tiresome here to enumerate.

ON THE CORN LAWS. 617

I am far, however, from agreeing with the ingenious author of the enquiry into the causes of the wealth of the nations, in thinking that no corn laws at all are necessary: on the contrary, I believe a judicious system of corn laws would contribute, more than almost any other political regulation, to promote the tranquillity and internal prosperity of this nation. This opinion of Dr Smith I combated soon after the publication of his book *. He at one time declared, that he did intend to answer it, and took steps to ascertain facts respecting that subject; but afterwards laid the design aside. Most of the facts that he enquired after are now brought forward by the very ingenious writers of the treatise above quoted; and these facts, in the most decisive manner, overturn his theory. I therefore hold it as a point proved, that, in this particular, the judgement of Dr Adam Smith, which in many other articles is much to be relied

* See observations on the means of exciting a spirit of national industry, Letter XII. P. S. quarto, published *anno* 1777, by Robinsons, London.

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on, had been misled by the fascinating charm of an attachment to a favourite system; and I take notice of it here merely to put the reader upon his guard against being misled by an attachment to that great name, so justly respected in general in this country.

That a well regulated bounty on the exportation of corn, and duty on its importation, would tend to encourage the agriculture of this country, and to *moderate*, not to enhance, the price of corn, is evident, not only from abstract reasoning, but well established facts, the reader will be satisfied, if he shall consult the works above quoted. And although the corn laws of Britain, from the Revolution, when the bounty on corn was first adopted, till the year 1773, were defective in several essential particulars, so as to operate in a very imperfect manner, compared to what they might have done; yet, even under that defective application of them, and notwithstanding the other discouragements to agriculture, developped in the first es-

say in the present volume, this nation was found to be capable of not only supplying its own consumption of corn entirely, but of sparing annually a considerable overplus to other nations. Whereas, since the year 1757, when the corn laws began to be suspended, and frequently thereafter, till 1773, when the old system was in a great measure abandoned, the manufactures of this country being cherished, advanced into the most flourishing state, while its agriculture received so severe a check, that the production of corn has been thereby diminished to such a degree, as to force us now to rely on foreign nations for a considerable part of the necessaries of life; and thus the prices have been gradually enhanced*. But it was not till the year 1791, when the new re-

* It appears, from the tables exhibited in the work referred to, that the average importation and exportation of corn to and from Great Britain for forty years; viz. from the year 1710 to 1750, inclusive, when the original bounty laws were in force, compared with the same average for

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gulating system was adopted to its full extent, that the *coup de grace* was given

twenty years, from 1773 to 1793, when the alterations blamed were adopted, were as under ; viz.

Quarters.

From 1710 to 1750, the average quantity of grain of all kinds imported into Britain, was

<i>per annum</i>	—	—	20,976
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Ditto exported	—	—	665,435
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Balance *per annum* during this period in favour of Britain

	—	—	644,459
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From 1773 to 1793, the average quantities of corn of all sorts imported into Great Britain,

<i>was per annum</i>	—	—	733,938
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Ditto exported	—	—	303,781
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Balance *per annum* during this period against

Great Britain	—	—	430,157
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During the first period the exports exceeded the imports

	—	—	644,459
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During the last period the imports exceeded the exports

	—	—	430,157
--	---	---	---------

making together	—	—	1,074,516
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being the difference between the produce and the consumption of Great Britain, during an average of years at these two periods.

to our corn laws. It is since that time only, that the pernicious consequences

This singular change of circumstances may be easily accounted for, (without attending to lesser particulars,) merely by adverting to the state of the importation-laws during these periods.

During the first period, wheat could not be imported till the price amounted to 53s. 4d. : nor even then under a duty of 16s. *per quarter* ; if above that price, and not exceeding 80s., the duty 5s. In the latter period, wheat, when at or above 48s., might be imported, on paying a duty of only 6d. *per quarter*,

Rye, &c. during the 1st period, when not above 4cs. paid a duty of 16s ; if above that price, 4s. *per quarter*.

During the 2d period, if above 32s., the duty was only 3d.

Barley, during the 1st period, when not above 32s. *per quarter*, paid 16s. duty ; above that price 2s. 8d.

During the 2d period, when above 24s. the duty was only 2d. *per quarter*.

Oats, during the 1st period, when not above 16s. paid 6s. 5d ; when above 16s. the duty was 1s. 7d. *per quarter*.

During the 2d period, oats when above 16s. paid a duty of only 2d. *per quarter*.

These alterations were avowedly intended to lower the price of corn in Britain, below the natural standard that the state of this country must fix upon it, in spite of any laws that can ever be made to prevent it ; yet, instead of producing that effect, it has unfortunately, though necessarily, happened, that in consequence of the full operation of that system of legislation, which was evidently calcula-

of that system have been fully experienced. I ventured to point out to the public, in the year 1793, in a very concise and cursory manner, a *few*, and but a very few, of the striking absurdities of that

ted to make this nation depend upon others for bread-corn, the rise of prices, occasioned partly by a necessary diminution in the quantity of corn produced in Britain, but chiefly by spreading an alarm, which under these circumstances is scarcely to be avoided, has been such as to involve the nation in great calamity. Nor have half the evils that will arise from the derangement of economy produced by that cause been as yet experienced. The nation will soon but too severely feel them.

That the alteration in the course of the corn trade is to be attributed chiefly to the state of the corn laws, is evident by inspecting the tables above referred to; for, from the Union till the beginning of the year 1757, the corn laws being allowed all that time to remain unchanged, the exportation of corn went on gradually encreasing, while the imports were next to nothing; so as that in the year 1750, the exports exceeded the imports by 1,667,459 quarters. In the year 1757 the corn laws were first suspended, and never afterwards were permitted to operate freely. From the moment when these laws were first suspended, the importations began to encrease, and the exportations to decrease, so that in the year 1775, the imports exceeded the exports by 972,400 quarters, making a difference between the quantity of corn produced in this island in the years 1750 and 1775, of no less than

law.* These animadversions happened to fall in the way of some persons pretty high in administration at the time; who, instead of endeavouring to correct the glaring absurdities there exposed to view, have only since then expressed their astonishment that any individual should dare to point out errors of legislation with such undisguised freedom as is there done. Since that

2,679,859 quarters. This difference, amounting to about one fourth part of the average consumption of Great Britain, cannot be attributed to a change of seasons, but to other causes. What the balance will amount to in the years 1795 and 1796, remains yet to be ascertained; but it is easy to perceive that it must be very great.

I do not enter at all into the consideration of the corn act 1791, as it would require elucidations far beyond my present limits.

N. B. Some alteration of the corn laws are now, I understand, in contemplation. What these proposed alterations are, I know not; but I know that while the foundation on which they stand remains unchanged, the superstructure must be so defective, as to be in want of perpetual repairs, which can only serve to destroy, rather than to benefit the country.

* See the periodical work called the Bee, Vol. 18: published at Edinburgh; and sold by the Robinsons, T. Chapman, and T. Kay, London.

time, the effects of these laws have been more seriously felt than before; and had I been able to enter at all upon the subject at present, it must have called forth a much more severe tone of indignant reprehension than it produced on that occasion.

That these laws have tended to diminish the production of corn in this island, and to enhance its average price, * and must continue to do so as long as they shall be suffered to exist,—could be easily proved, did circumstances admit of it at present: but I am far from attributing the enormous prices, that have for so long a time deranged the economy of this nation, entirely to a diminution of the crop, originating either from this or from any

* Observe, I say, *average* prices, for whatever tends to raise the price of corn at one time extravagantly high, tends also to bring it at another time unreasonably low, as I doubt not will be soon experienced in this island. This fluctuation of prices is indeed one of the greatest evils in civil society, and one of the principal objections to the corn law in question: but however low prices may sometimes fall, the *average* prices must always, under their influence, be considerably above par.

other cause. This phenomenon must be ascribed chiefly to political manœuvres of various sorts, arising from circumstances that when explained would tend to excite a smile, if it were not checked by a contemplation of the extent of the pernicious influence of effects that have originated from such trifling causes. Among these circumstances, *one* of very great influence indeed, is, that the subject chanced to attract the notice of the public, towards the close of a Parliament, when a general election is expected to take place : for had it happened soon after a general election, when men's minds are in a comparative state of repose, many discussions, that have been brought forward with great eagerness by a variety of individuals, would have been passed by with indifference. In that case, a member of Parliament, instead of opening, like the leader of a pack of hounds, in full cry on the popular subject of a care for the welfare of the lower orders of the people, with a view to excite their veneration for his character at

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the next election, would have contented himself with eating his own bread in quietness, and allowing others to do so in the way they pleased, at such prices as they could obtain it for. Nor would others, fearing they might be thrown out at the next general scramble, have found that it was necessary not only to follow, but to try to outdo these first starters by still more violent vociferations. Neither would the minister, with a view to display his parental regard for the flock over which he for the present watches, have thought it incumbent on him to depart so far from his proper business, as to become, like Julius Cæsar, and many other Cæsars, the dispenser of corn to the people; and thus to derange the whole system of that domestic economy which ought ever to be preserved, like the apple of the eye, in a well regulated state. No man can have such a mean opinion of the talents of the minister, as to believe he did not perceive this long before the period arrived, when, fearing that the

great drains upon the treasury, occasioned by this measure, might afterwards be productive of disagreeable consequences to him, he obtained a recommendation from the committee of Parliament not to interfere farther in the commerce of corn. Nor will it be credited but that many men of sound understanding in the House of Commons, and of all parties, who have been emulous which should come most forward in this struggle of apparent humanity, did not perceive at the moment, as well as other sensible men did, that this contest only tended to frustrate the end it *apparently* aimed at, and to enhance the prices of corn to the poor, instead of lowering them. The history of the present period, if ever it shall be developed with the necessary degree of impartiality, intelligence, and precision, will afford one of the most interesting lessons to the political enquirer: for never before was the power of the imagination of men, in overruling the practical business of a great nation, in a matter of such serious and

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universal concern, as the price of bread-corn, so clearly ascertained ; nor could the means that produced this wonderful effect be developped with so much facility and precision. Other instances indeed have occurred, in the present day, of the irresistible power of the imagination of men over practical affairs of the first importance ; but it will long remain a matter of much greater difficulty, to trace with precision the causes that led to these astonishing effects.

On the whole, there can be no doubt but that this nation possesses the means of abundantly supplying itself with provisions of all sorts, were its population augmented even to a degree far beyond what is in the contemplation of any person at the present moment, if such measures were not adopted by the Legislature, and leading men in the country, as tend to depress that business below the level of other professions that are open to every man in this island ; and of course to abstract from agriculture that capital, genius and indus-

try which ought to have been appropriated to rural enterprises. Among the measures that would lead to this salutary end, no one could prove of such extensive influence as a system of corn laws grounded on principles that should tend to ensure a steady market to the farmer, at reasonable prices, under all circumstances. Were such a law made, which should be simple in its operation, comprehensive in its influence; and should it be freed from those numerous petty *regulations* that tend to fetter individuals in the management of their own private affairs, which it is so much the spirit of the present day to delight in; and which, as they cannot be executed, give rise to innumerable frauds and evasions that derange the public economy,—render the laws disrespectful in the eyes of sensible men,—perplex the legislators, and occasion those innumerable alterations, under the title of *amendments*, of our laws, which so much disgrace our code; and were this simple efficient law, when once made, to be suffered to operate

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steadily for a sufficient length of time, no person can form an adequate idea of its beneficial tendency. * But till a set of

* I have met with few persons who have adverted to the fall of prices that a steady market for any article, of production especially, will necessarily insure, if the demand be only great enough and long enough continued. It is indeed too often believed, that if you increase the demand, you must augment the price; whereas the reverse of this is the truth, provided only that demand be large and steadily continued for many years; though it is an undoubted truth, that a *temporary* augmentation of demand must tend to raise the prices at the time. Of the influence of a great and steady demand, in moderating prices, a better instance need not be produced than the case of London, in which market the average price of corn is considerably lower than in the counties around it, or the average of the kingdom at large. But perhaps a particular fact, of less extensive influence, may prove a more satisfactory evidence, to some, of the general position, here assumed. I therefore shall state the following one, that consists with my knowledge.

About thirty years ago, the taste for making large plantations of the Scotch fir so much prevailed in Aberdeenshire, that many millions of these trees were planted each year; the consequence was, that extensive nurseries were there established, and the price of these plants was so much lowered that they might be easily obtained there for fourpence *per* thousand; though in almost every other part of Scotland, where the demand was less considerable the selling price was usually from 2s. 6d. to 3 shillings^s

men can be found, who shall be seriously disposed to enquire with candour into the principles upon which such a law should be constructed, without having a view to any kind of party influence whatever, nothing else can be expected but a series of futile expedients, that are subjected to a state of perpetual fluctuation, the natural tendency of which is to drive us, in time, like antient Rome, to depend upon other nations for our support. If the experience of past times, the sufferings that we ourselves at present experience, and the derangements that must soon flow from it, do not produce a conviction of the necessity of seriously adverting to this subject, nothing that I could say would prove of any avail. Here therefore I conclude.

per thousand. For some years past, the demand for fir plants has there greatly decreased, larch being preferred, so that for a million at that time, a thousand can scarcely now be disposed of. The consequence of this change is, that the price of fir plants has risen to 2s. 6d. or 3 shillings *per thousand* there, as in other places.

THE END.

ERRATA.

From the unavoidable absence of the Author, on some occasions, and other circumstances, the following errors, with some others, of lesser consequence, have escaped notice.

In motto to *Essay First*, line 1. for *ceurs* read *coeurs*. *Ibid* line 2. for *ou l'un* read *ou l'on*.

- PAGE 20 Line 1, for *banish* read *punish*
 — 30 — 11, for *that is* read *that it is*.
 — 33 — 18, for *:* read ,
 — 41 Last line, for *impossible* read *impolitic*.
 — 83 Line 8, for *preclude* read *precede*.
 — 134 note line 4, from bottom, for *became* read *become*.
 — 145 Line 15, *dele* be.
 — 208 — 2, *dele* who
 — 245 — 13, for ; read, *ibid* last line, f. *exertions* r. *exactions*.
 — 306 — 3, from bottom, for *turnips* read *pease*.
 — 325 Last line, for *loosing* read *losing*.
 — 345 Line 10, for *affected* read *effected*.
 — 352 — 15, for *practice* read *produce*.
 — 358 — 5, for *healthy* read *heathy*.
 — 379 — 2, from bottom, for *toches* read *toizes*.
 — 382 — 14, for Vol. I. read Vol. XI.
 — 384 — 10, for *tables* read *tablets*.
 — 392 — 7, from the bottom, for *troughs* read *theds*.
 — 399 — 5, for *Raphael, Urban,* read *Raphael Urbin*.
 — 403 — 14, for *praised* read *prised*.
 — 406 — 10, put 35 in the blank space.
 — 412 — 9, for *salex* read *salix*.
 — 413 — 3, from the bottom, f. *than* other r. *than any other*.
 — 419 — 14, for *feul* read *fuel*, several times repeated in that paragraph.
 — 425 — 2, for L. 3 : 4 : 2 read L. 34 : 2
 — 427 — 5, for *begin* read *began*. *Ibid*, line 17, for *waltes* read *twists*.
 — 430 — 14, for *imbibded* read *embedded*.
 — 446 — 1, for *culling* read *cutting*.
 — 447 — 4, for *short* read *shorter*.
 — 449 — 9, for *as in* read *as, in*.
 — 455 — 7, for *than a higher* read *thought a high*.
 — 400 — 8, for *bark* read *bank*.
 — 464 — 3, from bottom, for *bending* read *binding*.
 — 465 — 7, from bottom, for *strewn* read *grown*.
 — 467 — 12, for *rather reverse* read *rather the reverse*.
 — 503 — 3, from bottom, for *rate* read *ratio*.
 — 559 — 2, for *they* read *the*.
 — 568 — 4, for : read ,
 — 590 — 16, for *baccifera* read *baccata*.
 — 600 — 3, from bottom, *dele* *stakes* and.
 — 623 note Line 15. for *destroy* read *distress*.



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